REPUBLIC OF INDONESIA

FEASIBILITY STUDY REPORT
ON
THE DEVELOPMENT PLAN
OF
THE [illegible] PORT

AUGUST 1976

JAPAN INTERNATIONAL COOPERATION AGENCY

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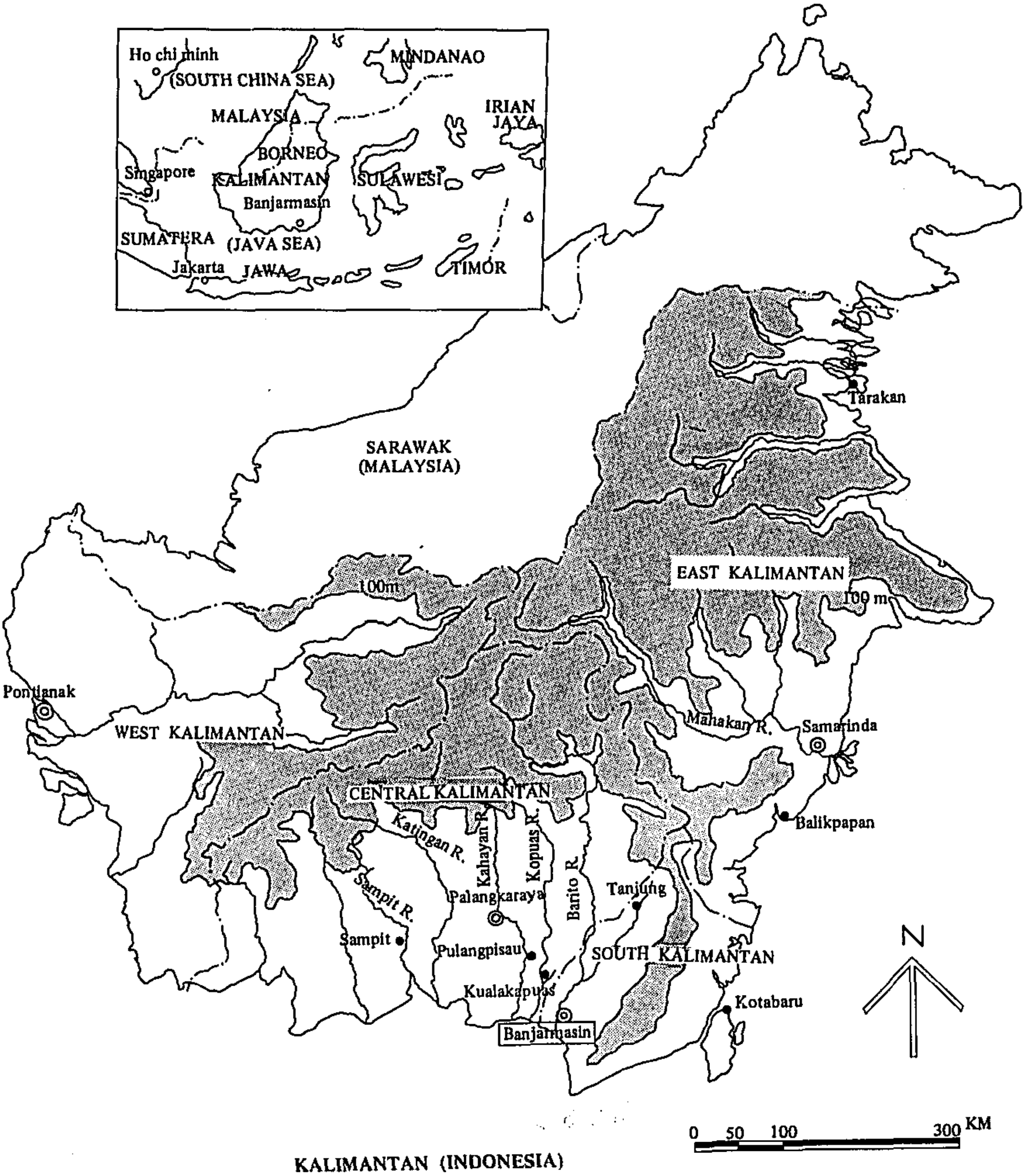
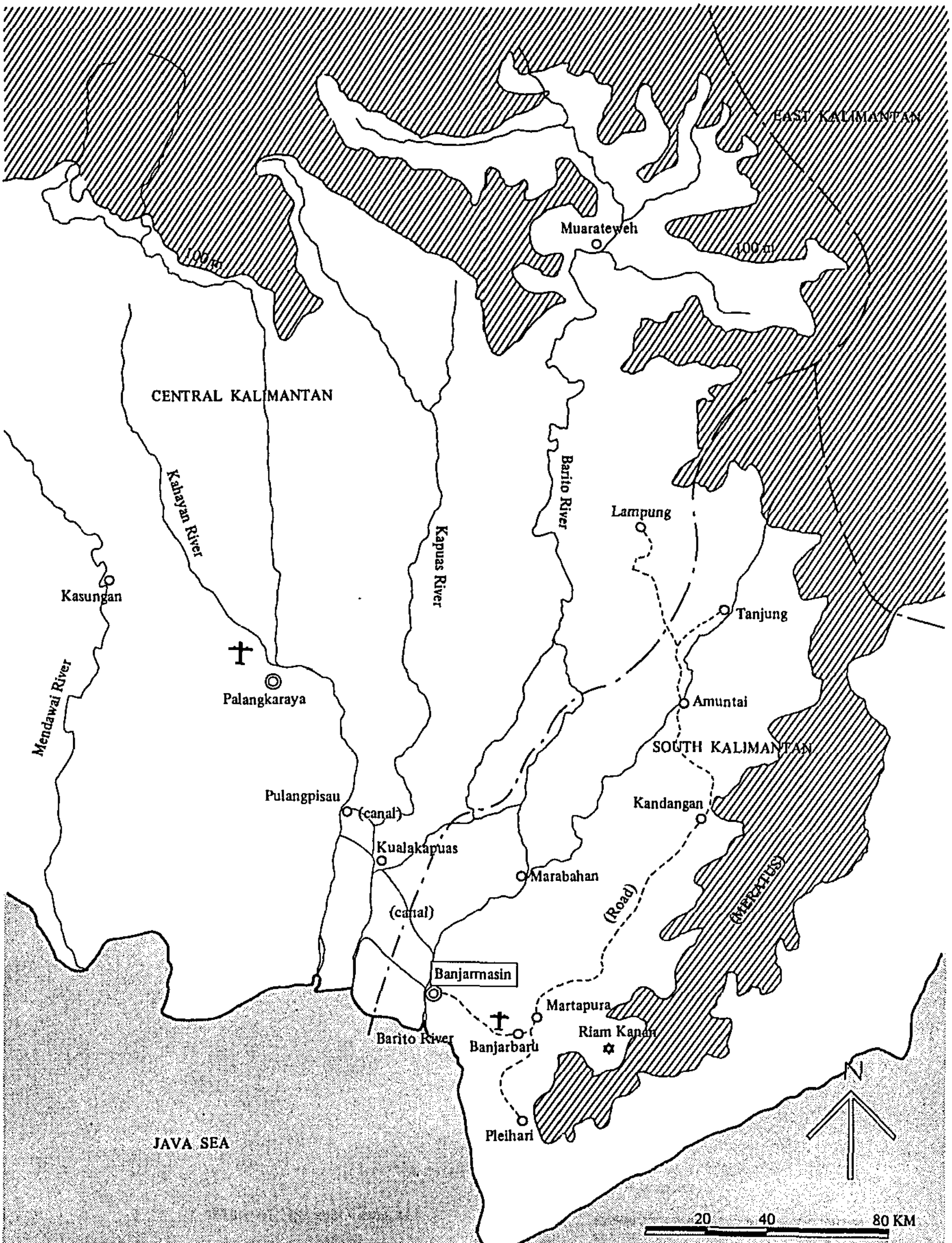
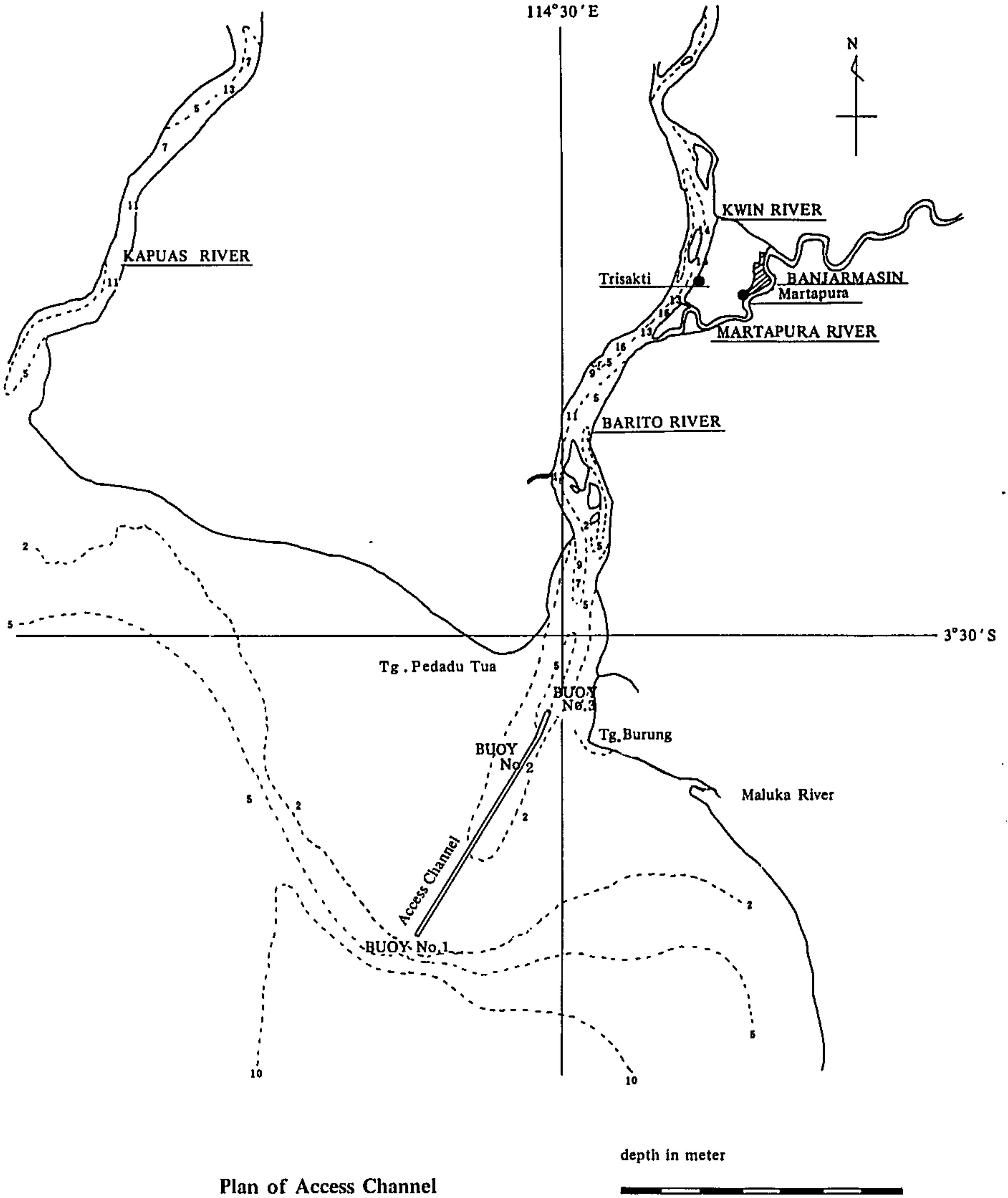


KALIMANTAN (INDONESIA)


EAST KALIMANTAN
Muarateweh
100 m
100 m
CENTRAL KALIMANTAN
Kahayan River
Kapuas River
Barito River
Lampung
Tanjung
Kasungan
Mendawai River
Palangkaraya
Amuntai
SOUTH KALIMANTAN
Pulangpisau
(canal)
Kandangan
Kualakapuas
Marabahan
(canal)
(Road)
(MERATUS)
Banjarmasin
Martapura
Barito River
Banjarbaru
Riam Kanan
Pleihari
JAVA SEA
N
20
40
80 KM



Plan of Access Channel

PREFACE

In response to the request of the Government of the Republic of Indonesia, the Government of Japan decided to make as part of its technical cooperation program a survey of the Indonesian plan to develop and construct a port at Banjarmasin and the Japan International Cooperation Agency conducted a preliminary survey to obtain necessary data on the Barito River during the period from July 15, 1976 to September 11, 1976. The preliminary survey team consisted of 4 members led by Mr. Shoichi Kitajima, Senior Inspector for Port Construction of The Fourth District Port Construction Bureau, Ministry of Transport.

This preliminary survey was followed up with a site survey conducted by a 9-member group led by Mr. Yoshio Takeuchi, President of the Overseas Coastal Area Development Institute of Japan, during a 45-day period from September 2, 1976 to October 16, 1976. The feasibility surveys conducted by these 2 teams were successful owing to the close cooperation and assistance of the Indonesian Government.

The findings obtained through these surveys, after their thorough studies and evaluation on the basis of the Scope of Work provided by and agreed upon by the Indonesian and Japanese Governments, have been submitted as an interim report and a final draft report. The Agency dispatched a mission to Indonesia when each of the above-mentioned reports was completed in order to discuss the report with the Indonesian Government, and make corrections where necessary.

This report is the final one incorporating corrections and opinions of the Indonesian Government.

We strongly hope that the Banjarmasin Port Development Project will be put into effect very soon to promote Indonesia's economic development, and contribute to the strengthening of friendly relation between Japan and Indonesia.

In conclusion, we would like to express our gratefulness to the Government and to the people of Indonesia for their close cooperation and assistance extended throughout the survey.

Shinsaku Hogen
President,
Japan International Cooperation Agency

STUDY ORGANIZATION

The Japan International Cooperation Agency (JICA), official agency responsible for implementation of the technical cooperation programs of the Government of Japan, organized a Banjarmasin Port Feasibility Study Team of the following membership in order to arrange a Master Plan of Port Development.

Member List of Japanese Feasibility Study Team:

Mr. Yoshio TAKEUCHI (Team leader)	President The Overseas Coastal Area Development Institute of Japan (OCDI)
Mr. Toshiaki OKADA (Senior advisor)	Deputy Director General, Techniques The First District Port Construction Bureau, Ministry of Trnasport (MOT)
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Mr. Minoru TAKASE	Counsellor Special Development Cooperation Dept. Japan International Cooperation Agency (JICA)

Member List of Japanese Physical Survey Team;

Dr. Shoichi KITAJIMA	Chief, Engineer Ministry of Transport (MOT)
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SUMMARY

1. Basic Conceptions of Port Development

1-1. Roles of ports in Kalimantan development

Kalimantan district is regarded to allow full achievement of regional development if various policies are taken such as the promotion of various industries including agriculture and forestry, and the improvement of infrastructure including ports and others, since the district holds abundant natural resources.

Ports play important roles in the promotion of regional development. In addition to the function as junctions between land and sea transportation, ports provide the fields for industrial production and serve greatly the formation of urban communities.

Banjarmasin Port in the Kalimantan development should be regarded to serve as a junction of transportation, to function as industrial field for coastal industries, and to orient the formation of Banjarmasin City.

1-2. Selection of a Regional Development Base

In promoting regional development, it is advisable to properly select a city or area as a nucleus of development, for promoting the development with it as the nucleus.

The superiority of Banjarmasin City as the nucleus of regional development has been confirmed as a result of examining the concentration of population, conditions of economic activities, states of traffic facilities improvement, actual use as a strategic point of transportation and communication, availability of energy, past intensification of infrastructure, etc.

1-3. Development of Ports for Promoting Regional Development

For effective regional development, infrastructure including ports must be properly improved, to promote local industries and to assist their development. As a result of comparative examination of various ports in the area covered by the project from various viewpoints, it is concluded that Banjarmasin Port should be selected as the port to be improved with priority in the district, in light of geographical features, outlook for development of various industries in future, prospect for transportation system in future, etc.

The development of Banjarmasin Port should be promoted aiming at the achievement of regional development of the southern area of Kalimantan centered on Banjarmasin City.

1-4. A Few Suggestions Concerning Port Development

For planning regional development by improving infrastructure including Banjarmasin Port, harmonized development of various industries in the region is a prerequisite. For the attainment of regional development, positive policies must be development to promote agriculture, forestry, etc., and to cultivate industries which use the products from those industries, thereby making local economic activities brisk.

In addition to promoting the port development, the promotion of various industries must fully be taken into consideration.

Port development plays an important role for the formation of the city concerned. Port development must be executed always under coordination with the planning of urban development.

The maintenance dredging of the channel at the mouth of the Barito River which affects the fate of Banjarmasin Port exerts grave influence on the development of the port. With the shoaling state of the channnel at the river mouth properly grasped, maintenance dredging must be executed to keep the channel safe enough.

2. Regional Transportation Traffic Pattern

2-1. Regional traffic and the Service Area of Banjarmasin Port

In view of the present situation of traffic facilities in the service area of Banjarmasin Port, the areas located behind and strongly connected with Banjarmasin Port are the coasts of Barito, Kapuas, and Kahayan, in the region with road networks developed on the west of the Meratus mountains. In addition, it is estimated that the mutual connection of these areas will be strengthened by improving and expanding the present traffic facilities. As a result of various examinations, these areas are considered as the service area of Banjarmasin Port in light of traffic conditions.

On the west side of Kahayan Coast of Central Kalimantan, the traffic network is divided at present by river basins, and the area is lacking in connection from east to west. So it should be excluded from the service area of Banjarmasin Port in examining the plan for the time being. Furthermore, Kotabaru was not included in the service area of Banjarmasin since it is separated in economic activities. Banjarmasin Port should be planned separately from the oil harbour, viz. Balikpapan Port of East Kalimantan, considering the mutual distance, geographic features, economic relations, etc.

2-2. Change of Physical Distribution Pattern

Outgoing goods from the service area are now transported from the places of production through waterways or roads to the port, being delivered out of the region.

As an example of incoming goods, consumer goods are mostly brought into

Banjarmasin Port by ocean going vessels and domestic travel vessels. The goods brought into Banjarmasin Port are allocated according to the market mechanism of Banjarmasin City, and the allocated goods are distributed through waterways and roads to the respective areas of the service area.

When the development of the service area will be promoted in future, the goods passing through Banjarmasin Port will increase quantitatively, and the quality of cargos will change, causing the change of physical distribution pattern.

An assumed physical distribution pattern in future is as follows:

(1) Main outgoing cargoes will comprise agricultural products, forest products and their processed products, being collected from a considerably wide range.

(2) Banjarmasin Port will be a transit port of almost all outgoing cargoes, excluding a part of logs which will be exported through Pulang Pisau Port.

(3) The cargoes brought into the port will partially be loaded directly into vessels, and partially be stored in the port area until they are delivered.

(4) Import cargoes are handled by liners. Domestic travel vessels calling at the port are loaded with general merchandise, and also bulk cargo and liquid cargo.

(5) Change in incoming cargoes will be the relative increase of imports in inbound cargoes.

(6) Incoming cargoes will partially be stored and processed in the port area, without being directly transported to the respective areas of the service area.

2-3. Assumption of Population and Production

The population was estimated as follows, by employing the growth rate of the other islands than Java of PELITA-II (Indonesian National Economic Development Program Phase 2nd) as the population growth rate of the service area of Banjarmasin.

(In 1,000 persons)

	1971	1983	2000
Population of service area (Growth)	2,008 (100)	2,800 (139)	4,500 (224)

According to PILITA-II, the growth of labor population is 2.55%/year, being planned about 0.2% higher than the total population growth of 2.35%. On the assumption that there will be also a similar tendency in the service area, the growth rate of labour population in the service area is assumed to be 3.08%.

Based on this growth rate, labour population can be obtained as follows:

(In 1,000 persons)

	1971	(1973)	1983	2000
Labor population of service area	676	(715)	970	1,600
Rate to total population (%)	33.7	(34.0)	34.6	35.5

The labor population by industrial categories were estimated as follows, by using the per capita outputs by industrial categories:

(In 1,000 persons)
(Figures in parentheses are component ratios (%))

	1971	1973	1983	2000
Agriculture & Forestry	481 (71.2)	509	540 (56)	640 (40)
Manufacturing Industry	24 (3.5)	25	70 (7)	220 (14)
Other Industries	171 (25.3)	181	360 (37)	740 (46)
All Industries	676 (100)	715	970 (100)	1,600 (100)

As for per capita Gross Domestic Product (GDP) in the service area of Banjarmasin Port, at first GDPs for 1973 were estimated by weighing the population of both Central Kalimantan and South Kalimantan included in the service area, and then per capita GDPs for target years were estimated, with some conditions added.

(In US$/person)
(Figures in parentheses show growth rates)

	1973	1983	2000
Central Kalimantan	214 (1.0)	320 (1.5)	580 (2.7)
South Kalimantan	119 (1.0)	190 (1.6)	450 (3.8)
Service Area of Banjarmasin Port	140 (1.0)	220 (1.6)	480 (3.4)
Indonesia	126 (1.0)	190 (1.5)	450 (3.6)

The GDP of each target year in the service area of Banjarmasin can easily be obtained from population and per capita GDP.

(In 1,000,000,000 Rp)
(Figures in parentheses show growth rates)

	1973	1983	2000
GDP in the Service Area	124 (1.0)	250 (2.0)	900 (7.3)

The GDP by industrial categories in the service area were estimated based on the data by provinces already reported, considering the past changes of component ratios, by weighing populations of both provinces included in the service area.

The future of agriculture, forestry, etc. regarded to be main industries in the influential sphere was estimated, and their production quantities were grasped by as many kinds as possible. Then, with them classified into export goods, domestically outbound cargoes and home demand cargoes, cargo quantities at the port for the respective target years were estimated.

That is, as for agriculture, the present situations were closely analyzed, and the future of agricultural production was estimated from productivity, expanding trend of agricultural land, future of land utilization, etc. by kinds. As for forestry, present production quantities were grasped, and on the other hand, available volume in future was estimated, to examine the annual limit of cutting volume. Then, through outlook for timber demand and activity of timber industry in future, forest production quantities were estimated.

2-4. Estimation of Cargo Quantities Handled at Banjarmasin Port

The cargo quantities handled at Banjarmasin Port were estimated, being classified into foreign trade and domestic trade, and further into incoming cargoes and outgoing cargoes, considering the future outlook of various industries such as agriculture, forestry and manufacturing industry in the service area.

For estimating the export quantity, the export amount in terms of money of the service area was estimated, being divided by items, to be examined, as sharing of the amount among ports in the service area was estimated.

For estimating the import quantity, the quantities of demand by main items in the service area were estimated, and the quantities to be brought in from the outside of the sphere were obtained from the estimated quantities, being divided into those imported and those procured domestically. The estimated quantities of cargoes handled at the port were classified by types of packing, to facilitate the grasp of the quantities of port facilities to be improved.

The quantities of cargoes handled at Banjarmasin Port in the respective target years can be estimated as follows:

(In 1,000 tons)
(Figures in parentheses show growth rates)

	1975	1983	2000
Export	658 (1.0)	1,480 (2.2)	2,300 (3.5)
Import	17 (1.0)	70 (4.1)	240 (14.1)
Outbound domestic trade	220 (1.0)	500 (2.3)	1,800 (8.2)
Inbound domestic trade	291 (1.0)	760 (2.6)	3,200 (11.0)
Total	1,186 (1.0)1	2,810 (2.4)	7,540 (6.4)

Arriving and departing passengers at Banjarmasin Port were estimated by examining the increase of population in the service area, the outlook of future economic activities, increase tendency of income, etc. The number of passengers is estimated to be 35,000 in 1983, and 56,000 in 2000.

2-5. Outlook for Calling Vessels

The kinds, numbers and sizes of vessels calling at Banjarmasin Port are forecasted to be as follows, considering the outlook for the quantities of cargoes handled at the port, and the tendency of sea traffic.

(In number of vessels)

Kind of ship	1975	1983	2000
Ocean going vessel			
Liner	80	240	690
Tramper	172	270	190
Domestic travel			
Conventional cargo	4,838	8,080	11,670
Tanker	131	240	750
Total	5,221	8,830	13,300

The following sizes of ships are employed in the planning.

(In DWT)

Kind of ship	1983	2000
Ocean going		
Liner	10,000	15,000
Tramper	8,000	10,000
Domestic travel		
Conventional cargo	2,000	3,000
Tanker	2,000	3,000

3. Siltation at the Access Channel

3-1. Dredged channel at Estuary of Barito River.

1. Completion: October, 1976

2. Scale: 14.3 km extension, 6m deep, 100m wide, linear channel, (small change of course at 12.9 km from the river mouth)

3-2. Examination Concerning Siltation

1. River discharge: $(90-123) \times 10^9$ m^3/year

2. Suspended sediment: 50–100g/m^3 in river, 500–3,000g/m^3 in shallow water, 100–300g/m^3 at the offing end of the channel

3. Siltation during the dredging: Total volume of soil 4,700,000m^3 (11 months). Silted gradually from land side.

4. Shallow water deposits: Approx. 350,000m^3/year throughout the alluvial period

5. Siltation after completion: Almost constant rate on the offing side. Heavy siltation after closure of offing side, on the land side. Total volume of soil 4,500,000m^3 (135 to 180 days)

6. Estimated volume of silting soil:
   Final Survey to Final Inspection (Jul. 25 to Sep. 20)........................210,000m^3
   Final Inspection to 3rd Survey (Sep. 20 to Jan 23)........................1,740,000m^3
   Remaining period (Jan. 23 to Jul. 25)..500,000m^3
   Annual volume of siltation estimated is..2,450,000m^3

To perform periodic by draulic survey of channel to accurately grasp the condition of siltation, sounding of the longtudinal section and cross section of the channel and disposal area should be implemented as soon as possible. Periodical execution of various investigations concerning oceanographical condition, soil, etc. are also effective.

Clarification of siltation mechanism, quantitative grasp of silting states, influence to navigation, and discussion on the dredging plan are also urgent themes concerned of this subject.

4. Long-term Development Plan (PLAN - II)

4-1. The total quantity of cargo estimated to be handled at Banjarmasin Port in 2000 A.D. amounts to 7,540,000 tons.

1) The amount of cargo to be handled at the new wharf ....3,740,000 tons
2) The amount of oil to be handled at the dangerous wharf.............1,500,00o tons
3) The amount of handled at the river basin....................................2,300,000 tons

4-2. The present Banjarmasin Port is divided into the outer port area (Trisakti Wharf) and the inner port area (Martapura Wharf), and each area has its own functions. But, since the amount of cargo in 2000 A.D. is assumed to be about 6.4 times as much as that in 1975 and since the population of the city of Banjarmasin is assumed to be about 2.6 times as many as that in 1975, it is considered difficult to maintain the present inner port as it is because its land area and water area are extremely narrow. Accordingly, in this plan, the facilities planning was made on the idea that the present inner port be concentrated to the outer port area at least in 2000 A.D. and that the space which will possibly become empty be merged into a new redevelopment plan which will intend to use the empty space in connection with the market functions of the city.

4-3. As the location for the Banjarmasin Port development where the large cargo vessels can moor safely and easily and where it is possible to economically build and maintain the port and harbor or, in short, as the adequate port and harbor site, the section from the mouth of the Kwin River on the east side along the Barito River to the mouth of the Martapura River, which is about 7 kilometers long, was judged to be adequate in consideration of the topography of rivers and roads, conditions of the river flow and depth, relation with the port service area and roads linking the port with the cities in the service area.

The vicinity of the mouth of the Barito River where there is a shoal of about 1 up to 3 meters in depth extending 15 – 20 kilometers far out to the sea cannot be the adequate port project site, because large vessels are inaccessible to the port unless the shoal is dredged on a large scale for channel and basin. And because this site is 20 – 30 kilometers away from the center of the city and because there are bogs or thinnly forested wood in the vicinity.

The soil conditions in the area along the Barito River and around Banjarmasin city shows little difference and are almost the same. Therefore, this does not impose the restrictions on the selection of the port project site.

4-4. Land Use Planning

Banjarmasin city can be valued as the future center of economic activity as it is the key point for labour and transportation. The area in and around Banjarmasin city is composed of low wet land, and some part is left as in the state of waste land. But this city has many possibility to develop, if adequate urban planning to be taken to do. It is essential to carry forward the development of Banjarmasin Port in a coordinated with the entire development program of Banjarmasin city.

The population of Banjarmasin city will estimated to be 400,000 in 1983 and 730,000 in year 2000 A.D. And estimation shall be based on the population of 316,000 in 1976.

Supposing the future density of population in Banjarmasin city shall be 100 persons/gross ha. in 1983. and 70 persons/gross ha. in year 2000 A.D.

Projection of industrial area to be developed is estimated as follows:

	(1983)	(2000)
Production	82 million US$	367 million US$
Area	250 ha.	550 ha.
Number of worker	18,000 persons	45,000 persons

Traffic volume arising in and around the port area shall be some 2,900 cars/hour at the peak hour in 1983. In year 2000 A.D., quantity of goods arising in and around the harbour area shall be about 10,000 tons/day, and traffic volume shall be around 5,600 cars/hour. The possible traffic capacity shall be estimated at around 3,000 cars/hour on two lanes road and some 6,100 cars/hour on four lanes road. Consequently, at least a by-pass road with 4 lanes and some 30 meter width shall be needed in year 2000 A.D.

It will be necessary to carry out residential district planning, which is an important factor in city planning, with the following scale of housing and functions.

(1) Population density will be considered 100 to 150 persons per hectare and approximately 50,000 persons per block.

(2) Commercial facilities, administrative service facilities will be considered in planning these residential blocks.

Percentage and area of land usage by application in the future is estimated as follows:

	(1983)		(2000)	
	(area)	(%)	(area)	(%)
	ha		ha	
Housing	1,800	50	3,060	50
Commerical area	140	4	210	3.5
Business area	140	4	210	3.5
Industrial Zone	250	7	550	9
Port Zone	110	3	180	3
Roads & Rivers	580	16	920	15
Green Belt of Zone	580	16	980	16
Total of Urban Area	3,600	100	6,110	100%

4-5. Special Considerations in Working Out the Bajarmasin Development Plan are as Follows.

1) It is possible to moor large ocean-going vessels along the Barito River.

2) It is possible to moor the medium and small size vessels like interinsular vessels, local vessels, sailing vessels, along the Martapura river in PLAN - I and if water line is insufficient to operate afterward the part of banks of the Barito River will be able to use for mooring.

3) Consideration is given so that local vessels and sailing vessels are connected with Banjarmasin city in a convenient way.

4) The stepwise improvement in each planning term is designed to be complete in the term, and consideration is given so that each facility can be always brought together.

5) Consideration is given so that the industrial estate is linked with the port and harbor organically.

6) There should be enough room for development so that it is possible to meet with the modification in the future plan and changes in the exterior conditions.

4-6. The Summary of the Overall Planning of Banjarmasin Port is as Follows.

1) The quay for the foreign trade is built on the downstream side of the Barito River continuously from the existing Trisakti Wharf.

2) The interinsular vessels wharf for the domestic trade is built continuously from the newly built wharf for the foreign trade and further downstream and along the Barito River down to Martapura river Short Cut.

3) The local and sailing vessels wharf for the domestic trade is built by excavating a basin along the Tik Dalam river which is right upstream of the Trisakti Wharf

and into which the Barito River runs. Around the excavated basin is built a wharf, and also along the Barito River right upstream of the Tik Dalam river is built a wharf for medium and small size vessels.

4) For the accomodation of river boats and water buses is built an excavated basin at the back of the Martapura Short Cut.

5) For 3.74 million tons of cargo estimated to be handled at the wharf in 2000 A.D., the land area for the port and harbor terminal is planned to have about 130 ha, which is located in parallel with the Barito River and is of a dimension measuring about 2.5 kilometers long and 500 – 750 meters wide.

6) The total quay length (including the bulkhead) is about 5.6 Km.

7) Right behind the wharf are arranged the shed and the open storage across the 20-meter wide apron.

8) At the wharf for the foreign trade the open storage is arranged behind the sheds. The total area for the open storage is planned to be 17.7 ha. including the parking lot.

9) The total area for the administrative buildings relating to the port management and maintenance is planned to be 7.8 ha. including enough room for the future plan. The area for the port and harbor staff dormitory is planned to be 5.3 ha.

10) As the passenger terminal one berth is planned to be built between the foreign trade wharf and the domestic trade wharf almost at the center of the wharf. The passenger terminal is offered for both foreign and domestic passengers. A 1.7 ha. area is planned to be allocated to the combined use for the terminal building, parking lot, and green belt.

11) As the parking lot for the Palm Oil tank lorrys during cargo handling 1.0 ha. area is allocated.

12) A general warehouse is arranged behind each quay in the center of the wharf area. For the general warehouses and for cargo distribution and packing use, 23.4 ha area is allocated.

13) For the small craft base like river boats, water buses, a basin with a 1,000-meter long loading yard and a 10.8 ha. area for a wharf are planned.

4-7. The cargo handling capacity of wharf (converted in general cargo) for the foreign trade in 2000 A.D. is assumed to be 1,000 tons/m in view of the actual figures at Tg. Priok port and Surabaya port, planned figures in PELITA-II and other figures of other countries. With the interinsular vessels, this is set at 900 t/m, and with the local and sailing vessels, this is set at 600 t/m.

4-8. The wharf for the foreign trade including the existing 200 meters is planned to be extended to 940 meters with the construction of four new berths. The wharf for the domestic trade is planned to have a total quay length of 1,170 meters which are broken down into 6 berths (105-meter) (3,000 D/W) for the interinsular vessels and 6 berths (90-meter) (2,000 D/W) also for the interinsular vessels. For the local and sailing vessels, a 470-meter quay along the Barito River and another 1,300-meter quay around the excavated basin along the Tik Dalam River are planned.

4-9. The quantity of mineral ores and processed timbers is estimated to reach, with the foreign trade and the domestic trade combined, 800,000 tons and 1,500,000 tons, respectively. The mineral ores are transported from the upstream to the port by means of barges and loaded onto the ship. Since the timber-processing mills are located along the water line of Barito River and its surrounding areas, their loading onto the ship will be carried out with the use of barges. Assuming that the annual cargo handling capacity of one buoy berth is 200,000 tons, it is necessary to improve 12 buoy berths.

4-10. The total amount of investment for Plan - II whose target is 2000 A.D. is estimated at amount to U.S.$253.96 million for the construction of the planned wharf including the 740-meter long, 10-meter deep quay, the 1,170-meter long, 6-meter deep quay, the 1,770-meter long, 4-meter deep quay, and 10 mooring buoys (12 buoy berths).

Of the total investment, U.S.$118.95 million is in foreign currency while U.S.$135.01 million is in domestic currency.

4-11. **Depth of Channel**

The required depths of channel at the mouth of the Barito River is 2000 A.D. were calculated by kinds of ships, considering the maximum draft of calling vessels, expected sea level and keel clearance. In 2000 A.D., when a 10,000 DWT tramp vessel departs from The port in full load, a maximum depth of channel of 6.0 m is surmised to be necessary. In this case, the sea level is expected to be 2.0 m. As for liners, 15,000 DWT vessels larger than tramp vessels are assumed to call, but in half load, and therefore a 6.0 m deep channel is considered to be sufficient. This means that the present depth of channel of 6 m can meet the calling vessels in 2000 A.D. as it is.

5. Short-term Development Plan (Plan - I)

5-1. The total amount of cargo estimated to be handled at Banjarmasin port in 1983 will be 2,810,000 tons. Of this quantity, the amount of cargo to be handled at the projected new wharf including the existing Trisakti Wharf and Martapura Wharf will be 750,000 tons; petroleum products handled at the dangerous cargo wharf will be 290,000 tons; and the total of logs and lumber to be handled on the basin of the Barito River near Trisakti will amount to 1,770,000 tons (of this, 1,000,000 tons are logs).

5-2. The total number of vessels that called at Banjarmasin port in 1975 was 3,922 (ocean-going vessels 252, interinsular vessels 382, tankers 131, local boats 624, sailing vessels 2,533). A total of cargo handled at this port in 1975 was 1,185,000 tons of which 674,000 tons were foreign trade cargo and 511,000 tons of domestic trade cargo. The main cargoes of the foreign trade were export of 606,000 tons of logs, 27,000 tons of rubber, and 16,000 tons of processed timber while the main cargoes of the domestic trade were outbound of 180,000 tons of timber, and inbound of 34,000 tons of sugar, 15,000 tons of powdered cereals, and 12,000 tons of cement.

5-3. The basic facilities which are considered to be required by 1983 are 570 meter long wharf (including the existing Trisakti Wharf with 200 m length) for the ocean-going vessels and the interinsular vessels and the wharf with 510 m long (including the 348 m long Martapura Wharf) for such small vessels as local boats, sailing vessels, etc.

For the handling of logs and processed timbers on the river basin 9 buoy berths are needed.

5-4. The wharf for the ocean-going vessels and interinsular vessels is to be extended 370 m downstream from the existing Trisakti Wharf and taking into account the future use, the wharf is planned to be 10 m of design depth. The small vessels wharf which is expected to be newly built by 1983 is calculated to be about 160 meters. But considering that the small vessels cargo handling base must be transferred smoothly from the Martapura Wharf to the area along the Barito River, the 470 m long, 4 m design depth wharf is to be built upstream of the Trisakti district by 1983.

5-5. The cargo handling capacity at the ocean-going wharf in 1983 was assumed to be 900 tons/m in view of the actual figures at Tg. Priok port, Surabaya port, and the planned figures in Pelita-II. The cargo handling capacity at the interinsular vessels wharf was assumed to be 700 tons/m while the cargo handling capacity at the local vessels and sailing vessels wharf was assumed to be 500 tons/m.

5-6. The berths for the foreign trade are required to serve for the 8,000 D/W class vessels due to the restrictions on the depth of the channel. However, since there is little difference in the cost of construction due to the topography at the point of construction, they are planned to accomodate the 15,000 D/W class vessels in preparation for the future expansion.

5-7. Taking into account the change in the tonnage of the interinsular vessels in the future, the berths for the domestic trade are planned to accomodate the 3,000 D/W class vessels. Meanwhile, the tonnage of the local vessels and the sailing vessels is assumed to be 300 D/W. The small vessels departure and arrival terminal is planned to be 2 meters depth in connection with the depth of the canals.

5-8. From the past statistics on the cargo handling by the inter-island vessels, the share by means of the interinsular vessels is assumed to be 50%; the share by means of the local vessels is assumed to be 20%; and the share by means of the sailing vessels is assumed to be 30%.

5-9. As the structure of the wharf for the foreign trade, the piled wharf structure was judged to be adequate because of the substantially poor soil conditions, no need for giving consideration to the earthquake, and flow of the river. In the comparative design, the use of steel pipe piles as the legs of the piled wharf was compared with the use of reinforced concrete piles. However, as long as a plant to produce concrete pile is not built in Banjarmasin, the use of the steel pipe piles is more economical.

5-10. The steel sheet pile structure is adequate for the domestic trade wharf since this is assumed to be built along the excavated basin. In the comparative design, the use of the steel sheet piles was compared with the use of the concrete sheet piles. And, as the anchor, the vertical pile was compared with the batter pile. Because of the poor soil conditions, the use of the steel sheet piles in the main structure and, as the anchor, vertical steel pipe piles to be used are the most economical.

5-11. The 1,000,000 tons of logs to be handled in 1983 is to arrive in rafts and loaded onto the ships directly from the logs loading basin of Barito River. The precessed timbers and ply wood estimated to reach 770,000 tons are to be carried by barges and loaded to the ships at the same basin. The cargo handling capacity for one berth at the logs carriers basin is assumed to be 200,000 tons/year, improvements on 9 buoy berths are necessary. In the basin where the flow changes according to the change in tide and where the ships are feared to float around due to the winds, the two point mooring system is to be adopted. As the location of the logs carriers basin, the upstream of the Trisakti Wharf or the area along the east bank of the downstream of the Martapura river Short Cut is judged to be adequate in view of the topographic conditions.

5-12. The improvement on the navigation aids required for the careful maintenance and management of about 40-kilometer long channel and also for the safe navigation of the vessels must be proceeded in parallel with the improvement of the port.

5-13. The investment in the first phase planning starts with 1978, and the preparations for the required survey and engineering work including design must be made at least during 1977. The acquistion of land is assumed to be completed in the first two years, the full-scale construction works are scheduled to start in 1979, considering one year of preparatory period. The construction of the buoy berths is planned to start in 1978.

5-14. The total investment in PLAN - I whose target year is 1983 is assumed to amount to US$49.53 million. Construction of wharfs including the 370 m long, 10 m design depth wharf, the 470 m long, 4 m design depth wharf, and the eight mooring buoys are planned. Of the total amount of the investment, US$20.56 million is in foreign currency while US$28.97 million is in local currency.

5-15. Depth of Channel

The required depth of channel at the mouth of the Barito River is 1983 was obtained by the same calculation method as employed for the depth of channel in PLAN II, and maximum 5.6m is considered to be necessary for the vessels covered by the planning. This depth is necessary when a 8,000 DWT tramp vessel departs from the port in full load. The sea level at this time is expected to be 2.0m. Therefore, 6.0 m as a round number is employed as the depth of channel in the planning.

6. Economic Analyses

6-1. Primary benefits are expected in the following 4 points.

(1) The cargoes imported via Surabaya Port or Tg. Priok Port will be able to be imported directly after the development of the port. As a result, freight from the through port to Banjarmasin Port, cargo-handling charge, terminal freightage & sheddage at the transit port will be able to be saved.

(2) Together with the increase of population, inbound/outbound domestic cargoes will increase. If the increased amount of cargoes is assumed to be disposed by the present facilities, days of stay at anchorage for interinsular vessels, local boats and sailing vessels will greatly increase, but this demurrage can be saved after the port is developed.

(3) The transfer of export logs loading place from Taboneo in ocean to near Trisakti in Barito River will allow to decrease days of stay at anchorage for vessels, to decrease the losing rate and damage rate of logs, and to save towing fee.

(4) The export of processed timber will allow to increase added value.

6-2. Costs for analyses are calculated in the following 4 points.

(1) Capital dredging cost for the access channel at the mouth of Barito River

(2) Port investiment deducted taxes and shadow price

(3) Maintenance dredging cost for the channel

(4) Increment of operating cost of the port

As a result, internal rate of return is 24.1% for PLAN I, and 14.9% for PLAN II. Cost benefit ratio calculated at a discount rate of 15% is 1.42 for PLAN I, and 1.00 for PLAN II.

7. Financial Analyses

7-1. The analyses are made on the following assumption.

(1) Banjarmasin Port will be operated on a self-paying accounting system.

(2) The investment funds for the port are covered by the development fund (free of interest) of the Indonesian Government for 50%, and loans from foreign countries for the remaining 50%. As for loans, assumed are low interest loans (or credits) until 1983, and commercial-based loans for the after 1984.

(3) The maintenance dredging cost in future is assumed to be covered by the revenue of the Indonesian Government.

7-2. As a result, revenue & expenditure and financial position of Banjarmasin Port will undergo transitions as follows:

(Rp. millions)

	1976	1983	2000
Port revenue	360	2,430	10,080
Profit after depreciation & interest	30	600	780
Total assets	1,080	24,230	120,530
Fixed assets	870	21,490	106,330
Long-term loans		10,300	35,220
Government development fund	510	10,760	53,100

D.C.F. rate of return restricted to revenue & expenditure of the port is 5.0% for PLAN I, and 3.3% for PLAN II.

8. Port Administration and Operation

In the progress of development of Banjarmasin Port, the amount of cargoes handled in the port will increase and the port will gradually provide a character suitable for foreign trade port. Accordingly administrative organization for Banjarmasin Port must be enlarged and strengthened in conformity with administrative structures in other foreign trade ports in Indonesia.

The administrative structure must also reflect the particular characters of the Banjarmasin Port. That is, method of maintenace and administration for extremely long waterway with total length of 40 Km may be a problem imposed in organizing the administration structure.

The organization must be able to conduct various surveys for waterway, maintenance dredging and maintenance for aids to navigation. Important items to be noted are to administer the port extention and improvement while maintaining normal port functions, to administer the anchorage in lumber loading area without blocking the waterway, and to strictly control the navigation of vessels since the waterway is one-way channel and river channel.

9. Environmental Assessment

9-1. Having always a recognition that the natural environment on the globe is a fortune given to us human beings, we should wrestle with a development project. A development enterprise will bring more or less modifications of the nature do not result in destroying the nature.

9-2. Since the buffer green belt with a sufficient width is planning between the industrial area and the city development area and since the almost lumber industries tend to be located along the side of the Barito River, it is unthinkable that the located industries would impaire seriously the lives of the citizens in future. Yet, for make assurance, it is necessary that the enterprise sides should lead to take sufficient air pollution counter measures and offer financial aids, too.

9-3. It may be evaluated as a proper planning to have planned to locate main industrial lands along the side of the Barito River, because the exhausted smokes and bad smell gases from the factories would rarely flow toward Banjarmasin City, but flow almost along the Barito River and result to diffuse.

9-4. It is necessary to guide to locate the city type industries along the side of the bypass and to exclude strictly other type industries.

9-5. In order to maintain the safty for future, it should be put into planning from now that the urban waste water of Banjarmasin City is disposed with in the city so as not to flow it easily into basin of the port.

9-6. The water of the Barito River effuses steadily to the outer sea, and this might prevent a generation of some amount of oil pollution from inducing a servious disaster.

9-7. The large amount of water having been utilized as clean water will be exhausted into the river, but the temperature of the water of the said river might not rise because of its abundance, so that this might not cause any environment destruction.

CONCLUSION AND RECOMMENDATION

1. As a result of various field investigations and studies carried out in the projected area and data analysis including economic analysis, it can be concluded that the development of Banjarmasin Port is fully feasible by enforcing the Plan on the scale recommended in this report.

2. The plan was set up considering the role to be played by Banjarmasin Port in the development of Kalimantan district to include not only to serve as a junction of transportation, but also to function as industrial field for coastal industries, and to orient the formation of Banjarmasin City.

3. The Banjarmasin Port Development Plan was drawn up based on the vision of a port that matches the future of the Kalimantan district, notably the future of the Service Area of Banjarmasin Port and Banjarmasin City.

4. In selecting the basic point for a city or area as a nucles of development, considerations were given to such matters as follows.

(1) the accumulated degree of population and its density
(2) condition of economical activities
(3) condition of transportation facilities improvement
(4) whether is possitive result in the transportation and communication
(5) relative ease, or difficulty in receiving and supplying energy
(6) degree of infrastructure accumulation up to present
(7) natural conditions
(8) geographical conditions

After examining by comparison the cities within the projected area to be developed in relation to the items stated above, the superiority of Banjarmasin City as the core of development in a concentrative manner was confirmed.

5. Further, as a result of studies made on such point as follows,

(1) the geographical conditions
(2) future perspective on the development of various industries
(3) future perspective on transportation systems

it can be concluded that Banjarmasin Port should be selected as the port in the area to undergo improvement in a concentrative manner.

Development of Banjarmasin Port should be set forth with the objective of achieving regional development for the sourthern part of Kalimantan centering around Banjarmasin City.

6. The economy of district can be promoted and regional development can be achieved only when there is a harmony of activities among the various industries within the area, coordinating with the improvement of various infrastructures such as the port.

More specifically, the matters of promoting such primary industries as agriculture and forestry in an organic manner and to raise their productivities are matters of prime importance, while it is equally necessary to provide guidance towards gradually raising the high degree fabrication rate of the products of such industries in order to gradually increase added values and to enhance economic effects.

7. Regarding the development of the Port, it is essential that the Plan should be promoted in coordination with urban program included land use plan and plan of road network. Development of the area as a port city can be succesful only when urban planning is skillfully coordinated with port project.

8. To ensure smooth utilization of Banjarmasin Port and to give full play to its port functions, it is necessary to ensure perfect maintenance of access channel, about 40 km in length, and at the same time, it is necessary to improve navigational aid facilities and the Port Administrator should affectively the matters affecting the navigations in the channel.

9. The following table shows the future perspective on the scale of economy.

	Unit	Actural result	Estimation		Growth Rate		
		1971	1983	2000	1971	1983	2000
Population of Service Area	x1000 persons	2008	2800	4500	100	139	224
Employed population of Service Area	x1000 persons	676	970	1600	100	143	237
Share of income in Service Area	US$/capita	140	220	480	100	157	343
GDP of Service Area	billion RP	124	250	900	100	202	726

10. The following table shows the forecast of the port tonnage traffic handled at Banjarmasin Port

Unit: in 1,000 tons

Kind of Trade	Actual result	Estimation		Growth Rate		
	1975	1983	2000	1975	1983	2000
Export	658	1,480	2,300	100	225	350
Import	17	70	240	100	412	1,412
Outbound Domestic	220	500	1,800	100	227	818
Inbound Domestic	291	760	3,200	100	261	1,100
Total	1,186	2,810	7,540	100	237	636

11. The following table shows the forecast of the port tonnage traffic classified by type of commodity and by berthing facilities that will be handled at Banjarmasin Port.

Unit: in 1,000 tons

Facilities and commodities	Estimation			Growth Rate		
	1975	1983	2000	1975	1983	2000
Quay	(444)	(750)	(3,740)	100	170	850
General Cargo	444	650	2,332			
Dry Bulk		100	1,113			
Liquid Bulk			295			
Buoy and Anchorage	(606)	(1,770)	(2,300)	100	292	380
Dry Bulk	606	1,770	2,300			
Petroleum Jetty	(136)	(290)	(1,500)	100	213	1,103
Liquid Bulk	136	290	1,500			
Total	((1,186))	((2,810))	((7,540))	(100)	(237)	(636)

12. Regarding the future perspective concerning the ship calling, estimation was made of the number of ships and their scale, by analyzing the present condition, considering the trend of international marine transportation as well as the future prespective of transportation innovations, and by studying these matters according to each type of ship, that is, oceangoing vessel, interinsular vessel, liner and tramper. The table given below summarizes the results of future forecasts concerning ship calling.

Kind of Ship	Actual Results		Estimation				Growth Rate					
	1975		1983		2000		1975		1983		2000	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
(1) Ocean Going Vessels												
Liner	558	81	800	240	1,500	690	100	100	143	296	269	852
Tramp Vessels	3,523	162	5,000	270	8,000	190	100	100	142	167	227	117
(Timber)	3,523	(162)	5,000	(270)	8,000	(90)	100	100	142	167	227	56
(Others)	–	0	–	0	8,000	(100)	100	100	–	–	–	–
(2) Domestic Trade Vessels												
General	38	4,947	120	8,080	250	11,670	100	100	316	163	658	236
Oil Tanker	1,041	131	1,200	240	2,000	750	100	100	115	183	192	573
Total	–	5,321	–	8,830	–	13,300	100	100	–	166	–	250

Note : Item (1) means Cargo Load per Ship Call, unit in tons/call
Item (2) means Ship Calls per Year, unit in calls/year

13. In order to clarify the mechanism of siltation at the access channel, it is necessary to effect analysis based on actually measured data obtained from hydraulic surveys carried out over a substantially long period in a completed access channel, and from soundings carried out over and over again. However, since the present surveys had took place shortly after the completion of the access channel located at the estuary of the Barito River and since the measured data that were obtained were gathered under exceedingly limited conditions, we were unable to fully clarify the siltation mechanism of the access channel. As a result of analysis carried out on the basis of the various data that were available and by making some assumptions, it is possible to arrive at such tentative conclusions described as follows.

(1) Owing to the fact that the Barito River waterway is practically free of any suspended mud and because the concentration of the suspended sediment is considerably low except for some periods of ebb tide and flood tide, it is estimated that sand transported down the Barito River and discharged from it is expected small in volume.

(2) On the other hand, in the shallow water at the estuary of the Barito River where the access channel is located, the seabed is rapidly stirred by the waves during ebb tide, causing a large amount of suspended sediment to be generated, which, in turn, flows into the channel being led by the water flow, and thus contributes to siltation.

(3) Although it is difficult to describe the siltation phenomenon in a qualitative manner, the following can be said from the measured results up to present.

First, siltation takes place in the forward end of the access channel and then siltation is recognized at the upper-stream end of this channel. After this process is repeated, siltation seems to progress over the whole middle section of the channel.

(4) The annual siltation amount, which was found to be approximately 2.5 million m^3, was calculated by adding the estimated soil volume sought on the basis of the measured values obtained during the construction of the channel to the soil amount gained through measured data obtained after dredging operations, and then by setting up a hypothesis.

Since the presence of suspended mud was recognized in the channel, this soil volume was calculated by subtracting such suspended mud that was viewed as being irrelevant to the navigation of ships.

14. In carrying out maintenance dredging at access channel, it will prove to be good policy to carry out periodical surveying and investigation of the channel and to conduct dredging operations frequently at short intervals, rather than conducting collective, mass dredging after siltation has advanced substantially. From an economic standpoint, it will be effective to adopt the method known as partial dredging in which dredging is carried out for the forward-end area of the access channel, with an allowance given to the water depth.

15. The setting up of an even more adequate maintenance dredging program will call for continuous enforcement of the various investigations given below.

(1) Periodic soundings carried out along the access channel and its surrounding water.

(2) Hydraulic surveys such as of current condition and salinity concentration carried out along the access channel and its surrounding water.

(3) Sampling analysis of siltation sediments

(4) Continuous observation of tide.

16. The Banjarmasin Port Long-Term Development Plan (Plan-II) which envisages year of 2000 as the target year was drawn up in the following manner.

With regard to the cargo quantity of 3.74 million tons that is estimated to be handled at the port in 2000, the land for the port terminal was set as 130ha in area calculated on the basis of various original units. The port terminal are measuring about 2.5 km in length and 500 – 750 m in width is planned to be built in paralel with the Barito River and alongside of bank. The planned total quay length (including the transitional part of revetment) was set as 5,600m. Of the quay facilities, for the foreign trade quays, the total quay length was enlarged to 940m by adding four berths (185m each) of −10m quays (for 15,000DWT) to the existing Trisakti Pier (200m) along the Barito River.

Meanwhile, regarding the domestic trade quays, six berths each of 105m (for 3,000DWT) having a total length of 630m to be used chiefly for interinsular vessels are planned for construction along the Barito River centering around the Short Cut entrance. Also, six 90m berths having a total length of 540m for 2,000DWT are to be built along the Short Cut passage. With regard to the local vessels and sailing vessels wharf, 470m to be built along the banks of the Barito River upstream from the mouth of the Tik Dalam River that flows into the upper-stream side of the Trisakti Wharf and will continue along the banks of the upper-stream of the Barito River. In addition to this, a quay of 1,300 m length will be built along the bank of the mooring basin excavated along the Tik Dalam River.

The amount of exports, for both foreign and domestic trade, of mineral ore, log and processed timbers is estimated at 2.5 million tons. To handle such cargo, 12 buoy berths emploieing 10 units of buoys are planned for installation along the waterway of the Barito River.

17. PLAN–II was set up, envisaging as the basic port facilities, the consolidation of a −10m quay 740m in length, −6m quay 1,170m in length, −4m quay 1,770m in length and a −2m quay 1,000m in length and establishment of 10 units of mooring buoys. And as port functional facilites, the consolidation of the transit sheds having total floor area of 72,000m^2, open storage and truck terminal of 198,100m^2 warehouse with 82,810m^2 of total floor area, 204 fork lifts and 24 mobile cranes are also included in PLAN–II.

By adding such planned facilites as dock roads, palm oil tanks with pipeline a passenger terminal as well as bunkering, power-supply and water-supply facilities, the total amount of investment required is estimated at US$ 135.01 million in domestic currency and US$118.95 million in foreign currency, totaling US$253.96 million. This investment amount includes expenses required for consultant services and contingency (30% of the total cost).

18. It is essential that the development of Port Banjarmasin will be set forward in a form coordinating with the development plan for the whole Banjarmasin City. The basic city plans required for development were drawn up as described below, by estimating that the population of Banjarmasin City will be on the increase, reaching some 400,000 in 1983 and 730,000 in 2000, and by imagining the scale of the future City accordingly.

(1) Future population density was estimated to be 100 persons per gross ha. for 1983 and 70 persons per gross ha. for 2000.

(2) The industrial shipping amount in the Service Area was estimated to be US$ 160 million for 1983 and US$ 1.1 billion for 2000. Of the industrial land required to meet the above scale, the industrial area in the neighboring area of the Port was estimated to be of a space of 250 ha for 1983 and 550 ha for 2000.

(3) Generation of cargo in the future for the Port and its surrounding area and the number of trucks used per day are as shown in the following table.

Sort of Goods	1983		2000	
	Goods Volume (1000 t/year)	Number of Trucks per Day (truck/day)	Goods Volume (1000 t/year)	Number of Truck per day (truck/day)
Bulk Goods	263	188	1,565	1,118
Sundry Goods	420	1,500	1,329	4,746
Total	683	1,688	2,894	5,864

To comply with the increase in traffic demand that will generate in pace with the development of Banjarmasin Port, it is necessary to schedule to make a routes or more, each in two lanes, that will link the port area with the hinter-land though the urban district. In also calls for the completion by the year of 2000 of a new by-pass road with 2-ways, 4 lanes and 30m in width.

In this case, it is preferred that the port area and industrial area will be linked with the industrial roads, seeing to it that its passage through the urban district is avoided as much as possible.

(4) Although it would seem advantageous to promote development by setting high values on the accumulation of city functions of the present Banjarmasin City and using them as the nucleus for development, it would be better to use the present city center as the center of the future Banjarmasin City and to guide development activities towards this direction.

(5) A recreation land was set up by arranging greens and a parks of an adequate area to be planned along the upper-stream side of the Trisakti Wharf. Furthermore, it is recommended that low swamp area of approximately 300–400ha which is presently left untouched at the rear of port area must be reserved for future expansions of the Port. Thus, efforts should be made toward retaining the land, limiting its use for the time being as land for the residential district of general city dwellers.

(6) Regarding the basic structure of the urban area street system, the system will be composed by combining circular roads and radial roads, with the center at which the roads will meet, largely complying with the center of the present City. The residential area that will be divided by these roads will be approximately 100 ha each in area as a standard.

(7) As standard, the residential blocks will be approximately 400 ha, that is, a unit of four 100 ha residential areas formed by being divided by the chief arterial roads will constitute a block. In addition, in a single residential block, the distance to the commercial destrict will be approximately 1 km, that is, a distance that can be reached on foot. Furthermore, the plan envisages the inclusion of commercial facilities, administrative facilities and domestic industries within one residential block.

19. From 1983 onward, it will be necessary to transfer the functions of the Martapura Wharf to the area located along the banks of the Barito River. Regarding the remaining land following the transfer of the functions, it is recommended that the land will not be left unutilized, but instead be re-developed for use as a distribution center and commercial center characterized as a distributing market of daily commodities such as perishable foods, owing to the fact that the land is located adjacent to the commerical area and that it is an area characterized by its distributing functions of commodities centering on daily commodities.

20. In order to seek the planned water depth of the channel, studies were made of such points as follows;

(1) The maximum draft of port-calling vessels for each type of ship
(2) Loading condition of cargo during call at the Port
(3) Vessel arrangement situation of the various shipping companies
(4) The relationship between the expected sea level in the water basins involved and the port-calling ships

Then, after taking into consideration the keel clearance of ships, the results were analyzed. Consequently, the required depth of main channel for both 1983 and 2000 was estimated to be –6m. Therefore, from the fact that the present access channel depth of 6m is fully capable of meeting the requirements of ships calling at the port, it was judged that there will be no need to increase the depth of the access channel.

21. The Banjarmasin Port Short-Term Development Plan (PLAN–I) which sets the target year to 1983 was drawn up in the manner described below.

By making the target year coincide with the year 1983 which is assumed to be the target year of the Third National Development Plan (PELITA–III) of the Government of Indonesia, PLAN–I was interpolated into the Long-Term Development Plan (Master Plan) to ensure promotion of smooth development.

Breakdown of the 2.81 million-tons cargo quantity that is assumed to be handled at Port Banjarmasin in 1983, is as follows: 750,000 tons of cargo handled at the newly planned piers encluding the existing Trisakti Wharf and the Martapura Wharf, and 290,000 tons of petroleum handled at the Oil Pier, 1.77 million tons of logs and lumber handled at the Barito River Anchorage in the Trisakti area.

Meanwhile, the functions of the Martapura Wharf is to be transferred in the future to the area located along the Barito River banks, aiming at the centralization of port functions during the period up to 1983, but up to then it is to be utilized in its present condition, due to the fact that its close adherence with the general market is strong and that it is playing a significant role in commerical activities.

22. On the assumption that oceangoing vessels and interinsular vessels will be using the same wharf together, the required port facilities that will be capable of meeting the assumed cargo quantity of the port in 1983 was found, through calculation, to be as follows: quay of 570m length (including the existing 200m quay of the Trisakti Wharf) and a quay of 510m length (including the existing 348m quay length of the Martapura Wharf) for utilization by small vessels such as local vessels and sailing vessels totalling 1,080m (including 548m of existing quays). In addition to this, a number of 9 buoy berths is required in order to enable basin loading of logs and processed timbers.

23. With respect to the wharf for local vessels and sailing vessels, a –4m quay of 470m length will be constructed on the upper-stream side of the Trisakti Wharf by 1983, which also takes into account the smooth transferring of cargo-handling bases for small vessels from the Martapura area to the Trisakti area. For the common-use wharf for oceangoing vessels and interinsular vessels, continuous construction is planned of 2 berths of a –10m quay (for 15,000DWT) having a length of 370m in the section on the lower-stream side of the existing Trisakti Wharf located along the banks of the Barito River.

Meanwhile, the buoy berths to be used to handle logs and processed timber will adopt the 2-point mooring system. With 8 units of buoys installed, a total of 10 beths will be set up along the eastern coasts of Kembang Island located upper-stream of the Trisakti Wharf and along the eastern banks of the Barito River in the section between the mouth of the Martapura River and the entrance into the Barito River from the Short Cut.

24. With the initial investment for the Short-Term Development Plan(PLAN–I) planned for 1978, the present Plan considers the purchase of land to be completed in the first two years. The present construction work will be started in a full-fledged manner in 1979 following a one-year preparatory period. However, with a view toward making the facilities start functioning at the soonest possible date, start of construction for the buoy berths alone will take plan in 1978.

25. Basic port facilities planned for development and improvement in PLAN–I consist of a –10m quay, 370m in length, a –4m unloading platform, 500m in length (including

an approach part of 30m) and 8 units of buoys, while for the Port's functional facilities planned for improvement cosist of 30 fork lifts, 4 mobile cranes, 2 transit sheds having a total area of 16,500 m^2, a 34,200 m^2 of open storage, and warehouses having a total area in floor of 19,800 m^2.

In addition to this, dock roads, bridges and water-supply and power-supply facilities are planned for consolidation.

The cost of construction required for the above are estimated at U.S.$28.97 million in domestic currency plus U.S.$20.56 million in foreign currency, totaling U.S.$49.53 million.

26. In the economic analyses, since the taxes relating to imported materials and shadow price relating to wages of unskilled labours were subtracted, the aforementioned construction cost turned out to be as stated below.

	(Financial Cost)	(Economic Cost)
PLAN–I :	US$ 49.53 million is changed to	US$ 40.82 million
PLAN–II :	US$253.96 million is changed to	US$204.87 million

From the standpoint of national economy, such expenses as dredging cost of access channel (already paid) and maintenance dredging cost for the future, and future increase in the operating expenses were added as economic cost in addition to construction cost.

With the project's life time of 30 years, costs, benefits, internal rate of return (IRR) and cost benefit ratio (discount rate: 15%), all of which were calculated at the prices in 1976, were found to be as shown in the following table. These will prove the high feasibility of this project.

	Economic Cost (U.S.$ thousand)	Economic Benefit (U.S.$ thousand)	Internal Rate of Return (%)	Cost Benefit Ratio (15%)
PLAN – I	136,440	433,560	24.1	1.42
PLAN – II	407,440	702,930	14.9	1.00

27. In the financial analyses, calculations were carried out on the assumption that a self-paying accounting system will be adopted. Owing to the large depreciation expenses, the port charges in 2000 had to be raised to approximately 5 times those in 1975. Assuming that the present port charge level is deferred for 7 years (PLAN-I) and then raised to twice in 1984 and thereafter deferred, subsidy of 13 billion Rp for 1983 and 60 billion Rp for 2000 will be needed. As the investment of Banjarmasin Port is to be made in a scale approximately equal to that of a new port, there are needs to be borne the maintenance dredging expense by the government revenue and to be raised low interest funds in PLAN-I. Thus, financial viability of Banjarmasin Port will be endowed.

28. As the development of Banjarmasin Port advances, the Port which is oriented toward conventional domestic trade will, in all probability, grow into a port of international

trade with foreign trade holding large priority. As a matter of course, it is necessary to improve the port administration and operation system to comply with this change. In other words, Port Banjarmasin's administration and operation system should be consolidated in conformity to the administration and operation systems of other foreign trade ports. Matters to be taken heed of in the management of the Port basically consist of the following 3 points:

(1) to maintain non-profitting management,
(2) to ensure that the Port will not be managed from a political standpoint, and
(3) to make efforts toward maintaining independence in terms of finance.

After the present administration system is reviewed from such standpoints, it is necessary to improve the organization as soon as possible starting from the reinforcement of the service sector and financial sector.

Furthermore, while adding management services that are required for promoting foreign trade, immediate efforts should be also made toward consolidating an organized system that will handle such services as supervisory duties whose objective will be the planned supply arrangement of port labor force, coastal telecommunication services that are indispensable to contacting vessels entering and leaving the Port, management works for the sailing vessel wharf, and maintenance and administrative services to take care of navigation aids and maintenance dredging of the channel.

29. In order to ensure smooth development of Banjarmasin Port and to effect adequate administration and operation, it is recommended that a development committee, or a liason conference, organized by the Port Administrator should be regularly established for the purpose of making concrete adjustments of the Port Development Plan to match other various development plans such as of urban development and at the same time, to maintain a channel through which demand may be heard without losing valuable chances.

30. The wooden product fabrication industry including plywood factories and pulp factories is liable to generate offensive-smelling smoke and stimulant gas in addition to waste smoke. However, since the planned industrial sites are located along the Barito River centering on the waterfront area and because a buffer green belt of an ample width is arranged for location between the industrial site and urban developmnet site, and moreover, because the winds throughout the year show a tendency of prevailing in the area along the Barito River, which may be expected to have fine smoke-and-gas dispersing effects, it was judged that air pollution caused by the group of factories will not be of such a proportion as to pose any serious problem with regard to the Plan of this project.

Meanwhile, with respect to the area located along the bypass road that is scheduled for construction in the southern section of Banjarmasin City, a policy is needed to induce construction of city-type industries that will be comparatively free of waste smoke emission and that will not pose any air pollution problem.

31. While paying attention toward preventing contamination of the water inside the Port caused by vessels entering the port through such actions as ship bilge disposal, it is also necessary to set up adequate measures to counter permanent pollution by city drainage

discharged from Banjarmasin City. The matter of pollution prevention of Banjarmasin Port will pose no particular problem as we may place full expectations on the diluting effects of the enormous water volume of the Barito River, but if there is a mass outflow of petroleum from the Oil Pier and if it should coincide with high tide, the oil will not only be retained over a long period of time in the water basins of the Port causing pollution, but will also pose danger of inducing large hazards such as fire. Thus, while taking absolute care in the handling of petroleum it also calls for the perfection of the oil proof arrangement and protection arrangement for oil pollution and fire disaster.

32. The vast volume of water that will be utilized as cooling water for the factories located in the area will be discharged as warm water. But owing to the affluent volume of river water, it is inconceivable that there will be a rise of water temperature in the rivers themselves, so that it is equally inconceivable that it will cause destruction to the environment.

33. For the dredge employed for dredging operations to maintain the −6m water depth of the waterway, the trailing-suction hopper type (drag suction type) drege will be best suited, as it has such features as 1) being capable of excuting dredging without closing the channel, 2) having high mobility, and 3) affecting performance for dredging of linear, extra-long channel. It is judged that the dredge should have a draft of 5m and a hopper capacity from about $1{,}000m^3$ to $1{,}500m^3$. Since the annual dredging soil amount of a dredge of such a scale may be expected to be about 1.5 million m^3 to 2 million m^3, when the estimated annual siltation soil amount is considered, it follows that it will be necessary to carry out dredging operations throughout the year.

The water depths for the whole waterway area should be constantly monitored and efforts should be made toward carrying out dredging immediately for the places in which siltation has taken place, in order to reduce the soil amount to be removed by maintenance dredging. Frequent maintenance dredging operations carried out at the offshore-side end of the channel to prevent siltation at this point from serving as a trigger for siltation of the overall channel area, may be expected to contribute to economical maintenance dredging, as the place is close to the soil disposal ground located in the offshore-side deep-sea area and as the dredge may be easily operated due to the relatively large water depth of the areas surrounding the waterway.

Chapter-1

Overview

CHAPTER 1

OVERVIEW

1-1. Introduction

In response to the request of the Government of the Republic of Indonesia, the Government of Japan decided to carry out a study for Master Plan and Feasibility Study on the Banjarmasin Port development plan as part of its technical cooperation programmes, under the rules and regulations of Japan.

The Japan International Cooperation Agency (JICA), an official agency responsible for implementation of the technical cooperation programmes of the Government of Japan, will carry out the study in close cooperation with the authorities concerned of the Government of Indonesia.

1-2. Objectives of Study

The objectives of the Port Master Plan Study of Banjarmasin Port are reflected in the Terms of Reference agreed upon by both the Governments of Indonesia and Japan as set forth below.

a) To prepare the Master Plan (which will be referred to as Plan-II somewhere in the following) based on the comprehensive view of combining the long range plan (the objective year is 2000 A.D.) and the regional development project in the projected area.
b) To prepare a feasibility study on the short range plan, the improvement or expansion plan of the port in the first five years (hereinafter referred to as "the Plan-I"), which is coordinating the Plan-II.

1-3. Scope of Work and Methodology

In order to meet these objectives, the scope of work was set forth as encompassing several study items for Plan-I and Plan-II:

a) To examine and review the related reports to the plan;
b) Environmental condition;
c) Present situation and future prediction of the economic and social conditions;
d) Various development plans related to the projected area;
e) Scale, layout and facility improvement plan of the Banjarmasin Port;
f) Design, execution and siltation of the port;
g) Economic and financial analyses;
h) Port administration and operation;
i) Environmental assessment; and
j) Recommendation.

Surveys at the projected site were carried out in accordance with the following:

a) Basic data preparation was made through visits to the Local Governments of South Kalimantan and Central Kalimantan, National Planning Agency (BAPEDA), municipality and other organizations concerned;
b) For the past records, reports, etc. those collected by the Preliminary Study Team were utilized, while additional materials were supplemented;
c) For the hydraulic survey of the Barito River and borning survey of the projected site, the results of surveys of the Secondary Study Team were used for analysis;
d) For analysis of the siltation of the access channel, this study team conducted hydraulic observations on the sea for collection of the basic data, and at the same time, the findings of the Japan Industrial Development Co., Ltd. and Pacific Consultants International engaged in the dredging works at the site were utilized;
e) The following ports were chosen as related ports and were visited for field inspection to collect data,
   Port of Tanjung Priok,
   Port of Surabaya,
   Port of Sunda Kelapa,
   Port of Kotabaru,
   Port of Samarinda,
   Port of Pulan Pisau, and
   Port of Balikpapan;
f) Survey of the service area of the Port of Banjarmasin was carried out in two ways, viz. aerial inspection over a wide area by aircraft and land survey by means of jeep; and
g) Survey of the Banjarmasin City and its peripheral cities was carried out by means of jeep and foot.

Chapter-2

Basic Conception of Port Development

CHAPTER 2

BASIC CONCEPTIONS OF PORT DEVELOPMENT

2-1. General

Generally in "Port Development" for constructing a new port or extending and rearranging an existing port, the port itself is an important social capital with a close relationship with economic activities within a particular district affected by the port. However, the port development must be processed in a long-term base with a prospect or an outlook of 10 to 20 years for the future since its construction requires a large amount of investment.

The port is an entrance to a port city and a base for coastal industrial area and, in addition, it is a junction point of sea and land transportation, connecting its hinterland to foreland.

In the process of coastal area development with a port in its center of the scheme, the objectives of the development must be established and an approach that may bring a maximum effect is to be taken in conformity with the overall planning.

In scheming a master plan required for achieving the development of the Banjarmasin Port, its objectives will be clarified and basic approach will be described in this chapter.

2-2. Roles of Port in the Kalimantan Development

The Kalimantan district has a total area of 540,000 Km^2 and this is approximately 28 percents of total land area, 1,900,000 Km^2, of Indonesia. However, its population is merely 5,150,000 (according to a census taken in 1971) which is about only 4% of total Indonesian population, 118 million. It is seen that this population unbalance tendancy is rather progressing gradually.

It is one of great concerns of the government of Indonesia that both overpopulated and underpopulated areas are created at the same time as a result of gradual population flow from many islands to island of Java.

The Kalimantan district is rather undeveloped in many phases compared to the Java Island, so that the population has been lost and industries have ungrown resulting a lack of facilities required as a base for the society. This also resulted a losing population in this district, and another factor of the slow development of this district is its location that separated the district from other areas. That is, the middle and south Kalimantan district where47% of total Kalimantan population is concentrated, is blocked by mountains in its east and surrounded by sea in south, but such as Banjarmasin Port along the south sea side the coastline is covered with shoals and large ocean going vessels were unable to enter the ports until a large scale dredging had completed for the access channel, even if port is located inside of river. However, the Kalimantan district contains a rich forest resources, its large land area provides prospects for a large scale agricultural development and some mineral resources are also expected.

The forest resources should be taken into consideration in view of entire Asia, and it may be necessary to look into the agriculture of this district as a source of food for entire Asia, not only for one nation of Indonesia.

In addition, this rich land may be fitted to estate agriculture and to promotion of livestock raising with a hope to originate food industries based on the crops.

When analyzing the district as stated above, the direction of the Kalimantan area development will gradually discovered.

With other policies on population settlement, the following measures must be taken first:

(1) Execution of policies for providing smooth interconnection between the Kalimantan district and other islands.

(2) Promotion of agriculture and livestock raising with corresponding policies arrangement.

(3) Promotion of industries based on the materials obtained from the agriculture and livestock raising.

(4) Arranging infrastructures required in forming foundation for these policies.

In the execution of these policies, a port plays a very important roles. A port functions not only as a junction for sea-land transportation but also it provides a field for industries, promoting rearrangement of industrial foundation and, on the other hand, working in the formation of cities. Conventionally, a port is considered to be a point of traffic connecting hinterland to foreland, but this has been gradually changed recently. For example in Japan, a port is functioning as a field for coastal industries and also as a field for coastal city formation. The roles of the Banjarmasin Port in the Kalimantan development are just this traffic junction plus functioning as a field for industries plus to play in determining direction for the formation of the Banjarmasin City.

In the development plan of the Banjarmasin Port, the future of the Kalimantan district, especially the future of Banjarmasin City and the hinterland of the Banjarmasin Port, is drawn and corresponding visions for the port are provided.

The ports will provide transportation between islands, create fields for industries based upon crops of agriculture and livestock raising, and at the same time invite the industries required in the formation of the cities.

2-3. Selection of The Core for Regional Development (The Banjarmasin City as The Core of Regional Development)

In the process of regional development project, it is required to seriously study many cities to select a core city for regional development and many districts to select a core district within areas to be developed.

To effectively utilize the limited investment for the maximum spreading effect of the development, it is very important to verify, in planning, if core city or district of the development has a sign of possibility of growth with the area development. That is, the sign of possibility of the growth can be verified by examining the population density, economic activities, conditions of traffic facilities, past records of communication and transportation as key station, access to energy supply, degree of infrastructure accumulation up to now, etc..

After examining by comparison the cities within the area development in relation to the items stated above, the superiority of Banjarmasin City as the core of the development was verified by the reasons described below.

(1) Population density

The Banjarmasin City has the highest population density within the projected area.

Table 2-1 Population of Main Cities in the Service Area

Unit in x 1,000 persons

Name of State	Name of City	Population
South Kalimantan	Banjarmasin	281
	Martapula	59
	Kotabaru	34
	Tanjung	21
Central Kalimantan	Kuara Kapuas	35
	Pulang Pisau	13
	Palang Karaya	27

Note: Population for Banjarmasin and Palang Karaya is obtained from census of 1971, and others are from statistics of 1974.

The local government of South Kalimantan is located in Banjarmasin City. The local government of Central Kalimantan is located in Parang Karaya City but its population is merely 27,000, and population of the Central Kalimantan is merely 41% of South Kalimantan's population.

When comparing the population densities, the density of Central Kalimantan is about 9 times less than that of South Kalimantan.

Name of State	Population	Ratio	Population Density
South Kalimantan	1,699 x 1,000 persons	100	45 persons/Km^2
Central Kalimantan	702 "	41	5 "

(2) Farming land and Agriculture

Area of land usable for farming within district influenced by the Banjarmasin Port is assumed to be 3,800,000 hectares approximately.

73% of this farming land is in the plain spreading behind the Banjarmasin City within the South Kalimantan. From this fact, it is assumed that agricultural development for the time being will be started mainly from Banjarmasin City around and extend gradually to hills behind the city, and later will spread over west coast of the Barito River.

(3) Transportation and transport ship

Both the Barito River and the Kapuas River are connected approximately 135 Km upstream from the river mouth, and also connected at a point approximately 38 Km away from the Barito River by the Serapat Canal (28 Km long with 20 m average width) that can be used for transportation by boats. On the other hand, the Kapuas River is connected to the west side Kahayan River by both the Trusan Canal and Pulsan Pisan River for use in short distance transportation by boats.

Banjarmasin City is tied to nearby towns by means of large rivers such as the Barito River and canals connecting between these rivers. Also, the traffic between Banjarmasin and the city of Palang Kalaya, the capital of the central Kalimanta, can be made even by waterway only by use of rivers and canals

Such waterway by means of rivers and canals are widely used not only for traffic of people but also for transportation of foods and necessaries of life including shipping of agricultural products to market and transportation of forest products such as logs.

Origin of utilization of rivers and canal is the city of Banjarmasin, and junction between local waterway transportation and seaway transportation is the Banjarmasin Port.

(4) Multi-purpose dam and irrigation

The Riam Kanan Dam located 55 km northeast of Banjarmasin is completed in 1974. Its projected amount of stored water was 1,200 million tons and projected irrigation area was 30,000 hectares, and electric power of 30,000 kW was started to supply to Banjarmasin City.

The rich amount of stored water will make it possible to utilize the water for agricultural development in the area being considered, and excessive supply of electric power will be used as an indispensable energy for industrial progress in the years to come to promote the area development.

(5) Industrial and commercial activities

Many plywood manufacturing plants and lumber mills equipped with power machines have been built to start production last few years along the Barito River of Banjarmasin City. And total of five banks are in operation within the city with many stores engaged in more active commercial activities than any other cities.

(6) Ports and airports

The Banjarmasin Port has the largest amount of cargoes handled than any other ports within the vicinity, with a record of 1,190,000 tons in 1975. The wide sand bar located river mouth of the Barito River which had been a bottleneck for many years, was dredged in 1976 to provide a major access channel for Banjarmasin Ports. This will assure that the port will progress as the sole foreign trade port within the projected area.

On the other hand, the Banjarmasin Airport has a total of 2,100 meters for its runway as a key station of the airway connection between Java and other island.

(7) Telephone lines between the Banjarmasin City and other major cities in the Java Island are good for direct dialing as example by a line between Banjarmasin and Jakarta. This will make the Banjarmasin an information center of the Kalimantan. In addition, a coast radio station for communicating with ships was built in the city of Banjarmasin and it has been operated ever since.

2-4. Port Development for Promoting the Regional Development (Development of the Banjarmasin Port)

In the process of regional development for the projected area it is very effective, for steadily achieving the positive result of the development, to promote the growth of primary industries such as agriculture, forestry, etc. and to invite the other industries utilizing the products resulted from the primary industries. In the phase of execution, however, the infrastructures such as ports must be timely arranged to provide a smooth progress of the economic activities.

Three ports indicated below may be considered foreign trade ports for the projected area of the South Kalimantan and Central Kalimantan.

- Banjarmasin Port (Banjarmasin City)
- Kotabaru Port (Kotabaru City)
- Pulang Pisau Port (Pulang Pisau Town)

The Banjarmasin Port is in the Banjarmasin City along the Barito River and influential over not only the Banjarmasin City and South Kalimantan where present economic activities are brisk and future progress is expected but also widely over the Central Kalimantan.

On the other hand, the Kotabaru Port is located in the Kotabaru Island off from the Kalimantan main land and it exports mainly marine products and logs, but its hinterland is limited to the Kotabaru Island so that a connection with the projected area is extremely poor.

The Pulang Pisau Port located along the Kahayan River has only wooden piers for local boats and all lumber for foreign trade loaded within the river way. Population of Pulang Pisau is 13,000 only and back of this town is covered with jungle and swamps providing no particular industry other than logs loading. Also the river way of the Kahayan River is meandering so that sailing of large ocean going vessels is considered to be impossible even though a proper water depth is maintained.

As a result of studies and analyses on the geophysical conditions, forecast on future progress of various industries, and long-range views on the transportation system, it was concluded that the Banjarmasin Port should be selected as the port to be improved with top priority.

Imported goods required for the Banjarmasin City and other cities in the projected area had been transported from Tg. Priok Port and Surabaya Port since direct import to the Banjarmasin Port had not been possible due to poor conditions of the channel of the Barito River. After the completion of the channel of the Barito River mouth in 1976, calling of ocean going vessels to the Banjarmasin Port became possible. With the nominal and actual characters as foreign trade port, it is expected that the import goods will be gradually increased as the economic activities of the service area increase. It is also expected that not only the transportation of the agricultural products but also the industrial development headed by lumber manufacturing will rapidly progress with their products transported via Banjarmasin Port equipped with foreign trade functions.

The existing conditions indicate that the port facilities of the Banjarmasin Port must be quickly enlarged and improved to respond to the increase of transportation demands stated above, even though the port is studied independently from the regional development.

It was reported that the amount of cargoes handled only at the Martapura Wharf and Trisakti Wharf was 256,000 tons in 1975, excluding logs and others handled in river basin. When ignoring degree of oldness of existing facilities and expecting a perfect maintenance for the facilities, the maximum handling capacity of existing facilities is assumed to be 350,000 tons. This is merely 1.38 times amount of present handling, and it is about 1/2 of approximately 700,000 tons that assumed to be an amount of cargoes handled at the wharf in 1983. If this capacity is being maintained, the port capacity will be soon exceeded by the cargoes resulting a serious impact to the economic activities. This is another reason why a quick, drastic policy on the enlargement of the port facilities is to be established.

The development of the Banjarmasin Port must be processed to achieve the objective of the regional development for the south area of Kalimantan represented by the Banjarmasin City.

2-5. Some Proposals for Port Development

In the progress of regional development for the projected area from now on, the particular areas of importance should be carefully approached as stated hereinafter.

(1) Development of Industries within Port Service Area

It is an effective policy to invite industries for area industrialization for purposely promoting the economic development of certain area, but it is more important in early stage to promote primary industries such as agriculture and forestry in accordance with a plan to increase the productivity for guiding the industries in later stage to higher levels of industrialization using products made by the primary industries.

The local economy is progressed and regional development is achieved only when various infrastructures represented by ports, for example, are provided and activities balanced with various industries in the district are promoted.

Acceleration of wide area irrigation, selection of plant breeding suitable to certain area, promoting the improvement of farm land soil by fertilization for example, are all important means in the progress of the agricultural development.

For achieving higher utilization of forest resources, controlled felling must be strictly enforced in coordination with plantation and afforestation plan to make an effort in the conservation of resources.

Utilizing desolate canal for long transport after its improvement may be useful in saving time and cost for the promotion of the forestry. In view of regional development, the lumber should not be used only for export in form of log but it should be rather used in primary and secondary industries for saw mills and plywood manufacturing to promote the industrialization. To achieve the objective of inviting industries and improving the production activities, it is required to pay particular attention to realization of easier acquisition of industrial lands with lower costs, easier access to energy supply such as electric power, better protection and treatment in tax laws and maintaining stable labour supply. In addition a special protection in the area of finance may be also required.

(2) Coordination with Urban Development

As the port development progresses and port functions become workable in response to the transport needs within its service area, a city connected to the port is generally developed through the commercial and industrial activities related to the transportation and its diversified services. It is well known that the development of a port is very influential over the formation of city. The urban design including land utilization plan and road plan is to be preadjusted to the port plan with sufficient studies with a long-term forecasting to avoid an interference to the area development plan, and execution of the urban plan must be always coordinated with the execution of the port plan.

(3) The siltation and maintenance dredging of the channel at the estuary of Barito River

To assure a perfect operation of the Banjarmasin Port, the access channel connecting the Banjarmasin Port to the ocean must be perfectly maintained. A good facility may be completely useless if ships are unable to navigate to the ocean. The access channel is life itself of the Banjarmasin Port. Maintaining of the channle is the most important.

For the computation of the development effect of the Banjarmasin Port also, yearly amount of siltation should be estimated to find the amount of dredging for maintaining. The following investigation and surveys are required for the estimation:

(1) It is desirable to periodically survey the water depth repetitively over few years of the wide area of water around the channel.

(2) Hydraulic investigation should be conducted to know the hydraulic conditions in the channel and its surrounding area during rainy season.

The feasibility studies were conducted approximately at the time of channel dredging completion, thus investigation on the changes caused by the channel completion was not achieved. It is urgently required to start the investigation and survey with a full understanding on its importance. The results obtained from the investigation will be very useful not only for the computation of the development effects but also for timely execution of the maintenance dredging to economically maintaining the channel by using the technical data observed.

Chapter-3

Traffic Studies and Shipping Characteristics

CHAPTER 3

TRAFFIC STUDIES AND SHIPPING CHARACTERISTICS

3-1. General

In this chapter the traffic studies surrounding Banjarmasin Port will be described. First of all, from the present status of the improvements made on the traffic facilities and from the outlook for the future, the service area of Banjarmasin Port will be set. Next, as to the service area thus set, projection on the population and production will be made. Based on the projection, the outlook for the future traffic through the port will be forecast.

3-2. Regional Characteristics on Traffic and Port Service Area

3-2-1. Introduction

In this section Central Kalimantan, South Kalimantan and a part of East Kalimantan will be taken up as the regions related to the activities of Banjarmasin Port so as to give thought to the present status and the future of their traffic facilities, to grasp regional traffic characteristics and to set the range of their service areas.

3-2-2. Port

In those regions which seem to be related to the activities of Banjarmasin Port, i.e. in the regions including Central Kalimantan, South Kalimantan and a part of East Kalimantan, there are comparatively large ports like Pangkalanbun, Sampit, Pulang Pisau, Banjarmasin, Kotabaru, Balikpapan and Samarinda. Of them, Pulang Pisau, Banjarmasin, Kotabaru, Balikpapan and Samarinda allow the oceangoing vessels to directly enter their basins. Pangkalanbun and Sampit Ports have difficulty in maintaining their depth of water at the mouth of the rivers, so the cargo-handling for the ocean-going vessels is being made at Kumai and Samuda, respectively.

From these ports are exported large quantities of logs and other goods being produced in the above regions, and these ports functionally serve as a distribution center of the physical goods being transferred from Surabaya and also as a supply center of imported goods and other goods transferred from the other islands to their service areas. Balikpapan is also serving as a port to ship the crude oil which are being produced at Tanjung and the refined petroleum products made from produced or imported crude oil.

Pangkalanbun, Sampit and Pulang Pisau in the Central Kalimantan are ranked as the core for the growth pole in the regional development plan of this province. Banjarmasin which has been active originally as the center of an extensive regional hinterland is expected to grow further with the completion of the dredging work at the mouth of the Barito River in October, 1976 which was the bottleneck to the entrance of the ocean-going vessels.

3-2-3. Waterway

At Kalimantan the sea is shallow for 10 - 20 kilometers away from the shore. And since the shore of Kalimantan is not suitable for the site of port, each port is located, in many cases, at the mouth or in the mid-stream of a river. The traffic in this region depends to a larger extent upon the rivers. Adding to the Barito river, there are several big rivers running into the Java Sea in Kalimantan. Each river is utilized for the transportation by means of boats and rafts. In Kalimantan where the road construction is difficult because of the wedely spread swamps and the jungles, rivers, waterways connected to the rivers, canals and narrows are best utilized as a transportation network in place of the road. Along these waterways and canals the villages develop.

Barito River and its tributary rivers located upstream of Banjarmasin Port are frequently utilized particularly as traffic facilities and occupy an important part. These rivers allow the local boats, it is said, to navigate 700 kilometers upstream in the rainy season and 500 kilometers upstream in the dry season. Along the banks of the Barito River there are big villages like Marabahan, Amuntai, Tanjung, Buntok and Murateweh.

In the vicinity of Banjarmasin City there are four canals which are linked with rivers (See Table 3-1 for details). They are linked with three rivers: Kahayan, Kapuas and Barito. They are playing a significant role in the extension of the traffic range. However, part of the four canals has become shallow in depth. Therefore, if left under the present circumstances, it is not possible to expect these canals to play the role of a constantly stabilized traffic function. In addition to them, Marabahan Canal and the tributary river of the Barito River which meets Kapuas River play also vital roles (See Fig. 3-1).

In the future canal improvement project there is a planned canal which will run from Pulang Pisau in Central Kalimantan through Sampit to Pangkalanbun. And there is a report that part of the canal on the side of Pulang Pisau is already under construction. A dredging plan was made for the canals in the vicinity of Banjarmasin City in Pelita II. The dredging work is now under way (See Fig. 3-1).

3-2-4. Road

The road is well developed on the western side of the Meratus mountains. With the national road from Banjarmasin to Muarateweh placed at the center, the road network is filled with other provincial roads and still lower-level roads. These roads are linked with the canals and rivers everywhere, and at each node there is a well-developed village. The big villages developed along the roads on the western side of the Meratus mountains are Pleihari, Martapura, Rantau, Barabai, Amuntai, Tanjung and Murateweh.

West of Murateweh, low-level roads together with the upstream of the rivers form a traffic network in the north of Central Kalimantan.

The road which connects the regions on the western side of the Meratus mountains with the regions on the eastern side is still under-developed. To go over to the opposite coasts of Kotabaru, there are three roads. But they are all poorly maintained and still low-level in quality. Two of the three roads run in the hillside while the last one makes

Table 3-1 Dimensions of Canals

Canal	Length	Width	Depth below ground level	Depth of water	Observation time
Serapat	2 8km	25 - 30m	3 - 5m	1.4m, 2.1m	7:25 - 10:05 29 Sept. 1970
Tamban	2 6km	20 - 25m	2.5 - 5m	0.8m, 1.1m	9:40 - 10:50 30 Sept. 1970
Kelampan	1 4km	20 - 25m	2.5 - 5m	1.4m	6:20 - 7:00 30 Sept. 1970
Basarang	24.5km	25 - 30m	3 - 5m	0.9m - 2.3m	10:50 - 12:45 29 Sept. 1970

Source: Overseas Technical Cooperation Agency, "Survey Report of Development Plan along the Catchment Area of Barito River in Kalimantan in Republic of Indonesia" (Japanese Edition), March, 1971.

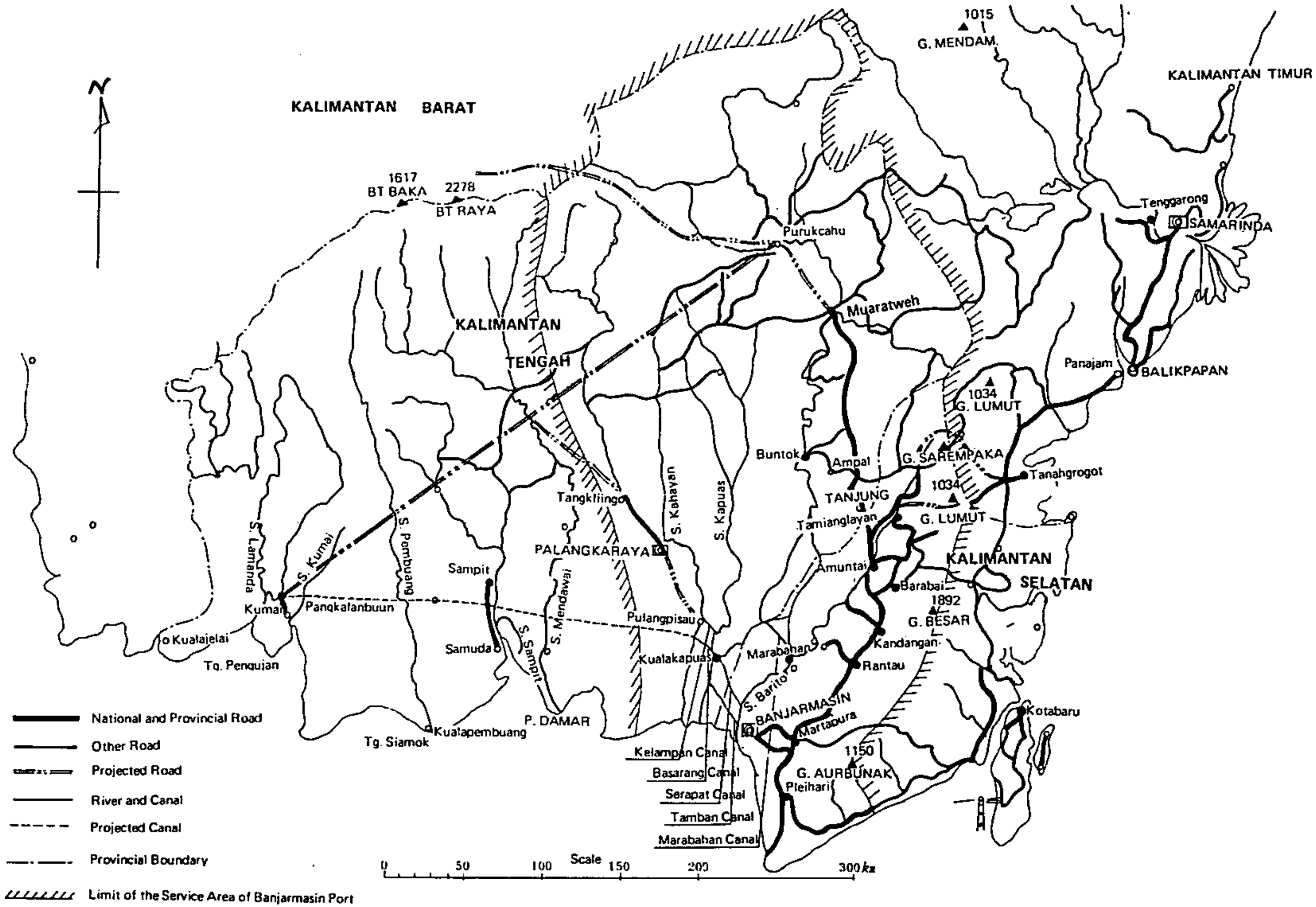


Fig. 3-1 Service Area of Banjarmasin Port

detour along the seaside. All of them are not used as traffic routes between the regions. From the western side of the Meratus mountains toward Balikpapan there is no road sufficient to allow the passage of cars. Along the eastern seaside centering around Balikapan there are high-level roads contributing to the inter-regional transportation. The road connecting Samarinda with Balikpapan has been recently completed and has become the trunk road for the two regions. For this reason the two regions form an independent traffic service area.

In the future road improvement project there is a plan to construct roads centering around Palangkaraya, the capital city in Central Kalimantan, and part of the road which leads to Tangkiling has already been completed. In the conception of the project there is a road which runs from the northeastern part of Central Kalimantan to West Kalimantan through the mountains and another road which runs from the northeastern part of Central Kalimantan to southwestern part of Central Kalimantan. There is a conception to strengthen the road crossing the Meratus mountains in the northern part of South Kalimantan (See Fig. 3-1).

3-2-5. Pipeline

The crude oil now being produced in the neighborhood of Tanjung, South Kalimantan, is pipelined to Balikpapan. In the oil refinery located at Balikpapan Port the pipelines to transport the crude oil from the oil field in the East Kalimantan region is laid out for operation.

3-2-6. Characteristics of the Regional Traffic and the Service Area of Banjarmasin Port

In view of the present status of the above-described traffic facilities, the regions with which Banjarmasin Port is strongly linked are the regions along Barito, Kapuas and Kahayan Rivers and the regions where the road network on the western side of the Meratus mountains is well developed. The linkage will become stronger if the existing traffic facilities in these regions were improved. From the standpoint of traffic conditions, the service area of Banjarmasin Port was considered to cover these regions.

On the western side of the Kahayan riverside of Central Kalimantan the traffic service area is broken from river to river, and the linkage from east to west is decisively lacking. Until the time when the conception of constructing an east-to-west road or a canal becomes concrete, the western side of the Kahayan riverside should be excluded from the service area of Banjarmasin Port in a practical sense.

In the Kotabaru District of South Kalimantan the villages are located along the seaside. They are strongly linked with Surabaya Port and receive the supply of goods via Kotabaru Port. In contrast, they are weakly linked with Banjarmasin Port. Therefore, the whole Kotabaru District was excluded from the service area of Banjarmasin Port.

The linkage between Balikpapan Port and the regions above considered within the service area of Banjarmasin Port is not strong enough because they are far apart from one another and because the road conditions are poor. Except the special installation (pipeline) for the special cargo - the oil - which runs from the regions to Balikpapan, there is only small quantity of physical distribution to those regions located in the middle between Banjarmasin Port and Balikpapan Port. Even if a road crossing the Meratus mountains were built in the future, it is very hard to think that the transportation by truck to Balikpapan on this route would become competitive with the transportation utilizing roads and waterways to Banjarmasin Port. This is because even the region most closest to East Kalimantan among the regions which are assumed to belong to the service area of Banjarmansin Port is located almost equally away from Banjarmasin and Balikpapan and because the route toward Balikpapan has the disadvantage that the hillside is steep whereas the route toward Banjarmasin has the advantage that both water transportation and land transportation can be utilized.

From the above disucssion, the service area of Banjarmasin Port was considered to be in the range as shown in Fig. 3-1. The outer boundary of this range is made to correspond to the provincial or district boundary for the convenience of statistical treatment.

Even if a further step was taken to compare the function of Banjarmasin Port with that of Balikpapan Port, it is hard to say that one port should be maintained while the other port should be abolished, because of the fact that both ports can be utilized for the foreign trade, since one port is 333 nautical miles away from the other.

If one dares to say, it can be said that Banjarmasin Port is a commercially functional foreign trade port based on its service area while Balikpapan has raison-d'etre as a foreign trade port of which functions are mainly the import and export of the crude oil.

3-3. Present and Future Pattern of Transport

The cargo goods now being transferred out of the service area arrive at the port through the waterways and roads from the origin of the cargo goods and is transferred out of the service area. Take, for example, the log which is the chief produce for the study of the present cargo flow pattern, it is known that the logs cut from the forest are bound into rafts which, in turn, are dragged through the waterways to Pulang Pisau and Banjarmasin where the rafted log are loaded up to trampers at the port. Part of the logs are hooked up to the factories located along the rivers and processed into timbers and plywood. These timbers and plywood satisfy, in part, the demand within the port service area and are loaded out of the service area via quay or buoy through the port.

Now, take the consumption goods as an example of inbound goods, it is known that most of the consumption goods are discharged out of ocean-going vessels and vessels for domestic use at Banjarmasin Port. Among the discharged consumption goods include such goods which were brought to Banjarmasin in the form of domestic trade from Surabaya Port where the goods had originally been imported. This is because the estuary of the Barito River which is the entrance to Banjarmasin Port is shallow in depth and has the difficulty against the entrance of ocean-going vessels. This once became a social problem when rice for emergency had to be imported at the time of drought. The consumption goods discharged at Banjarmasin Port is distributed through the market mechanism of Banjarmasin City, and the goods thus distributed are further transferred to the regions within the port service area through the waterways and roads. Every village along a river has a small wharf, and behind such village a market is formed in many cases. Part of the goods discharged at Banjarmasin Port is processed either in the city or out of the city, and the processed goods are distributed by the same physical distribution network described above.

At the stage where there was an advancement in the improvement as well as the development of Banjarmasin Port, the physical distribution pattern is considered to vary as the quantity of the goods is expected to increase and a qualitative change is expected in the future. The future physical distribution pattern will become about as follows:

First, the goods which are to be loaded out will assumingly be agricultural products, forest products and their processed goods. These goods are expected to be collected from a more expanded range than from the present range. Part of the agricultural and the forest products are to be processed in the vicinity of the regions where these products are collected. The remaining portions will be brought to the ports in the form of raw materials through the waterways and roads. Banjarmasin Port will become a transit port for almost all goods except part of the export of log. The log will be loaded out of Pulang Pisau in the future. Part of these products will be also processed in the water front industrial area to be built adjacent to Banjarmasin Port. These products will include such raw materials as needed for the manufacture of plywood, starch, rubber, etc. which require comparatively high processing technologies.

Part of the cargo goods brought to the port will be directly loaded onto freighters while the rest will be kept in storage until the date of their shipment. Plam-oil, frozen meats and other goods which require technical control during their storage are to be kept in tanks and freezing warehouses in the well-maintained port zone.

Liners will accommodate the import goods, too. If export goods rich in variety increased and if port were improved, the conditions for the liners crusing in the Java Sea to call at these ports would become better. There will be also domestic general cargo ships and bulk cargo carriers and liquid bulk cargo carriers to load and discharge the increasingly large quantities of bulk and liquid bulk cargoes.

The first change that can be considered as to the discharge is the relative increase of import against transfer. This is because the foreign products which had been traditionally coming to these regions in the form of transfer will now be imported directly to Banjarmasin Port. Most of the imported goods are general cargoes, which will be brought to these regions by the liners cruising around in the Java Sea. Part of the discharged goods are to be distributed or transferred to the regions within the port service area while the rest will be stored at the port or processed there. Particularly, iron and steel, cement and foodstuff will be processed first in the water front industrial area, and then their processed products will be transferred to the service area. Such existing ports as Kuala Kapuas and Pulang Pisau will function as influential distribution centers.

3-4. Projection of Population and Production

3-4-1. General

This section describes projection of the population as well as production in the service area.

The projection was made of the target year of Plan-I or 1983 and that of Plan-II or 2000 A.D. For the population, projection was made of the total population, labor force and its breakdowns according to the industrial sectors, and for the production, of the gross domestic production (GDP) and its breakdowns by industrial sector. Further, for the agriculture and forestry among the other productive activities, it was attempted to envisage the future aspects as they relate to the commodity distribution in that they were considered to be the most important sectors for the regional development and would have a great influence upon prediction of the future port traffic of Banjarmasin Port.

3-4-2. Population

According to the result of the national census taken in 1971, the population of the districts covered by the service area of Banjarmasin Port was: Central Kalimantan, 454,000 (64.6% of the total 702,000); and South Kalimantan, 1,554,000 (91.5% of the total 1,699,000); or in the total of the service area, 2,008,000. Thus, the percentage composition of the population of Central Kalimantan in the total population of the service area was 22.6%, and that of South Kalimantan was 77.6% (Table 3-2).

In Petita II, the growth rate of the population in Indonesia is estimated separately for Java and the other islands. The growth rate of population in the islands except Java is set at 2.88%/year which is higher than that set for the whole of Indonesia at 2.4%/year.

This growth rate of 2.88%/year in Petita II for the islands other than Java was taken as the growth rate of population in the service area of Banjarmasin Port for the sake of projection. Such growth rate is considered to be an adequate value from the recent trend of growth of the population in Central and South Kalimantans and also from the projection of the World Bank* as well as the Statistical Bureau of Indonesia.**

With this growth rate applied, the population in the service area is calculated as 2,800,000 in 1983 or 4,500,000 in 2000. The population in 1973 which will often be used in the subsequent forecasting is 2,100,000. The total population of the country is predicted, from the three kinds of data of Pelita II, World Bank and Statistical Bureau of Indonesia, at 160,000,000 in 1983 or 220,000,000 in 2000. Thus, the proportion of the population in the service area to the total population of the country is forecasted at 1.75% in 1983 or 2.05% in 2000 against 1.70% in 1971 (Table 3-3).

* IBRD, "Indonesia Development Prospects and Needs, Basic Economic Reports", April 15, 1975.

** Biro Pusat Statistik, "Perkraan Angka Kelahiran dan Kematian di Indonesia,," January, 1976.

Table 3-2 1971 Population in the Service Area

	Province (A) (x1000)	Service area (B) (x1000)	Composition (%)	(B) / (A) (%)
Central Kalimantan	(x1000) 702	(x1000) 454	22.6	64.6
South Kalimantan	1,699	1,554	77.4	91.5
Total in service area	2,401	2,008	100.0	83.6

Note: Calculated from the figures of Sensus Penduduk 1971.

Table 3-3 Forecasted Population in the Service Area

	Unit	1971	1983	2000
Service area (A)	(x 1000 persons)	2,008	2,800	4,500
Indonesia (B)	(x 1000 persons)	118,000	160,000	220,000
(A) / (B)	%	1.70	1.75	2.05

3-4-3. Labor Force

According to the result of the national census in 1971, the working population was 676,000, and this corresponds to 33.7% of the population in 1971.

In Pelita II, the annual rate of growth of the population of labor force is assumed to be 2.55% which is higher by about 0.27% than that of the total population at 2.35%. In the service area, it was assumed that the relationship of the labor population to the total population was the same to that in the national level, and the growth rate of the labor population was forecasted at 2.88 + 0.2 = 3.08%/year. Applying this growth rate, the labor force in the service area will be 970,000 in 1983 and 1,600,000 in 2000, and the proportion of the labor force to the total population is 34.6% and 35.5%, respectively (Table 3-4). In the table is included the labor force in 1973 estimated with the same growth rate.

Table 3-4 Projection of Labor Force

	Unit	1971	1973	1983	2000
Labor force (A)	(x 1000 persons)	676	715	970	1,600
Population (B)	(x 1000 persons)	2,008	2,100	2,800	4,500
(A) / (B)	%	33.7	34.0	34.6	35.5

The labor force by sector was projected with the industries divided into three sectors of agriculture, forestry and fishery, manufacturing industry and other industries.

In the forecasting, the level of per capita value added (GDP by sector/labor force by sector) in each sector in the future was assumed, and by this value, each GDP by sector was divided.

In 1971, the per capita value added of the agriculture, forestry and fishery was calculated as 79% of the mean of all industries, that of the manufacturing industry as 98%, and that of the other industries as 160%. The labor force at this time is that provided by the national census in 1971, and the values of GDP by sector are those discussed in paragraph 3-4-4 at (2). In 1983, by assuming the per capita value added of the agriculture, forestry and fishery as 80% of the mean of whole industries, and those of the manufacturing industry and other industries as 110% and 127%, respectively, the labor force of the agriculture, forestry and fishery will be 540,000, that of the manufacturing industry 70,000, and that of the other industries 360,000. In 2000, by assuming the per capita values added of the agriculture, forestry and fishery, manufacturing industry and other industries as 80%, 110% and 114% of the mean of whole industries, respectively, the labor forces by sector will be 640,000, 220,000 and 740,000, respectively (Table 3-5). In this table are included the values in 1973 upon the same composition of labor forces in 1971.

Table 3-5 Projection of Labor Force by Sector

Sector	1971	1973	1983	2000	Composition		
					1973	1983	2000
Agriculture, forestry & fishery	481	509	540	640	71.2	56	40
Manufacturing industry	24	25	70	220	3.5	7	14
Other industries	171	181	360	740	25.3	37	46
Whole industries	676	715	970	1600	100.0	100	100

3-4-4. Production

(1) Per Capita GDP

1973

The estimation of the per capita GDP in 1973 from the previously reported GDP and population forecast in paragraph 3-4-2 is as follows:

Central Kalimantan	214 US$
South Kalimantan	119 US$
Banjarmasin Port service area	140 US$
Indonesia	126 US$

Lacking of reports of the per capita GDP in 1973 in Central Kalimantan, forecasting was made in assumption that the differential of 1.7 times against the national mean in 1972 would continue to 1973.

The per capita GDP in the service area of the Banjarmasin Port was estimated with weighting of the population in those portions of both provinces which were included in the service area.

1983

In Pelita II, it is planned that the GDP of Indonesia will grow at an annual rate of 7.5% substantially. If it is assumed that this growth rate will continue thereafter, the GDP of Indonesia will be Rp 12.5 trillions in the 1973 market price in 1983. The population is 160,000,000 from paragraph 3-4-2. Therefore, the mean per capita GDP of Indonesia will be US$190.

1) In south Kalimantan, target was placed on dissolving the differential from the national mean;
2) In Central Kalimantan, 1.7 times per capita GDP of the national mean would be maintained as in 1973;
3) Per capita GDP in the service area was calculated with weighting of the population in those portions of both provinces which were included in the service area.

From the foregoing, per capita GDP was obtained as given below:

Central Kalimantan	320 US$
South Kalimantan	190 US$
Service area	220 US$

2000

Assuming that the growth rate in Pelita II will continue for GDP, the GDP of Indonesia in the 1973 market price will be Rp 41 trillions in 2000. From this value and the forecasted population, mean per capita GDP in 2000 is calculated as US$ 450.

Per Capita GDP in 2000 was forecasted upon the following conception:

1) In South Kalimantan, target was placed on dissolving the differential from the

national mean;

2) In Central Kalimantan, a value higher than the national mean by US$ 130 per capita would be maintained as in 1983;
3) Per capita GDP in the service area was calculated with weighting of the population in those portions of both provinces which were included in the service area.

From the foregoing, per capita GDP was obtained as given below:

Central Kalimantan	580 US$ per capita,
South Kalimantan	450 US$ per capita,
Service area	480 US$ per capita.

Table 3-6 Projection of per Capita GDP in the Sercice Area

	Per capita GDP (US$)			Comparison (%)			Multiplication	
	1973	1983	2000	1973	1983	2000	1983/1973	2000/1973
Indonesia	126	190	450	100	100	100	1.5	3.6
Central Kalimantan	214	320	580	170	170	129	1.5	2.7
South Kalimantan	119	190	450	94	100	100	1.6	3.8
Service area	140	220	480	111	116	107	1.6	3.4

(2) GDP

By multiplying the per capita GDP of the respective years of 1973, 1983 and 2000 by the population projected for the respective years, the values of GDP of the service area in the respective years are obtained as given in Table 3-7.

Table 3-7 Projection of GDP in the Service Area

	GDP (Billion Rp)			Multiplication	
	1973	1983	2000	1983/1973	2000/1973
Service area	124	250	900	2.0	7.3

(3) GDP by Sector

1973

The GDP values by sector in 1973 were estimated by the following procedure.

1) First, estimate the GDP value of the respective sectors in the service area from 1969 to 1972; In obtaining the past values of GDP of the service area, the previously reported data of the respective provinces were used. Such data were available for Central Kalimantan from 1968 to 1972 and for South Kalimantan from 1969 to 1973 so that the integrally applicable data were those from 1969 to 1972. The GDP value of the respective sectors in the service area was estimated with weighting of the population in those portions of both provinces which were included in the service area.
2) Next, calculate the percentage composition by sector of 1).
3) Then, extend the trend of 2) for one year to give the percentage composition in 1973.
4) Finally, apportion the GDP in the service area according to the 1973 percentage composition given in 3).

Through such procedure, the GDP value of the respective sectors in the service area in 1973 was estimated as shown in Table 3-8.

1983

The GDP value of the respective sectors in the service area in 1983 was forecasted by the following procedure.

1) GDP percentage composition by sector was forecasted.
   In forecasting the percentage composition, the change in composition of GDP by sector of the whole of Indonesia from 1973 to 1978 as planned in Pelita II and the actual composition of GDP by sector in this area were taken into consideration.
2) The GDP value in 1983 was apportioned to the respective sectors according to the foregoing percentage composition.

The GDP values by sector thus forecasted for 1983 are shown in Table 3-8.

2000

The 2000 values were forecasted similarly as shown in Table 3-8.

(4) Agriculture

1) Current status

The present agricultural production is summarized in Table 3-9. As shown, the current farm land in the service area is 474,000 hectares, of which 124,000 hectares or 26% is in Central Kalimantan and 350,000 hectares or 74% in South Kalimantan. The production is total 853,000 tons, 170,000 tons or 20% in Central Kalimantan and 683,000 tons or 80% in South Kalimantan. The

Table 3-8 Forecast for GDP in the Service Area by Sector

Sector	GDP (bln. Rp)			Percentage Composition			1983/1973	2000/1973
	1973	1983	2000	1973	1983	2000		
Agriculture, Forestery and Fishery	67.0	112	288	54	45	32	1.7	4.3
Mining	3.7	10	54	3	4	6	2.7	14.6
Industry	5.0	20	135	4	8	15	4.0	27.0
Construction	2.5	8	36	2	3	4	3.2	14.4
Tansport and Communication	3.7	10	54	3	4	6	2.7	14.6
Others	42.1	90	333	34	36	37	2.1	7.9
Total	124	250	900	100	100	100	2.0	7.3

main product is rice, occupying 81% of the farm land and 84% of the production, followed by rubber, coconut and fruits in terms of the farm land, or cassava, rubber, coconut, fruits and sweep potato in terms of the production.

The area of farm land per farmer is 1.24 hectares if the agricultural population is taken as 382,000 or 75% of the labor force of 472,000 in the agriculture, forestry and fishery.

Paddy production in the service area is 718,000 tons or 533,000 tons in rice when converted at a rate of 77%. From the amount of rice imported or otherwise introduced into the service area, it is possible to estimate the consumption of rice in the area:

a)	1973 Import in domestic trade	17,000 tons
b)	1973 Import	2,000 tons
c)	1973 Export in domestic trade	- 4,000 tons
d)	1973 Production	553,000 tons
	Total	572,000 tons

It will be seen that the import from the outside of the service area is of only a small amount at 3% of the consumption. The import and export of rice vary greatly with year so that such extent of import is scarecely considered to be significant. Then, it may be said that with respect to rice, demand and supply are well balanced. From the foregoing figures, the rice consumption per capita in 1973 is

$$572 \div 2.100 = 269 \text{ kg/man.}$$

Now looking the demand and supply of the other agricultural products, sugar and wheat are imported constantly as they are scarecely produced in the service area and are thus hundred percent dependent on the other areas.

Vegetables are also imported but only in a small amount. Therefore, it may well be said that in the service area, the agricultural products are of the same condition of demand and supply as in the case of rice except sugar and wheat.

2) 1983

The farm land to be developed newly in the service area during the period of Pelita II is estimated at 16,000 hectares in Central Kalimantan and 46,000 hectares in south Kalimantan, or total 62,000 hectares. The estimation was made in that the published basic data failed to indicate the location clearly so that it was required to apportion the planned development area of farm land according to the ratio of population inside and outside of the service area. The farm land area as of 1974 is 474,000 hectares as described in the foregoing.

Table 3-9 Current Status of Agriculture in the Service Area

Kinds of agricultural products	Farm land (1,000 ha)			Production (1,000 tons)		
	Central Kalimantan[1)]	South Kalimantan[2)]	Service Area	Central Kalimantan[1)]	South Kalimantan[2)]	Service Area
Wet land paddy	38	225	263	75	575	650
Dry land paddy	29	13	42	39	29	68
Sub-total (A)	67	238	305	114	604	718
Maize	3	2	5	2	2	4
Sweet potato	1	2	3	5	5	10
Cassava	4	3	7	29	18	47
Fruits		13	13		10	10
Miscellaneous		5	5		5 3)	5
Sub-total (B)	8	25	33	36	40	76
Rubber	36	62	98	11	24	35
Sub-total (C)	36	62	98	11	24	35
Coffee	1	2	3	1	1	2
Clove		1	1	1		1
Coconut	12	22	34	7 3)	13	20
Miscellaneous					1	1
Sub-total (D)	13	25	38	9	15	24
Total (A + B + C + D)	124	350	474	170	683	853

Note: 1) Data (A) and (B) of Central Kalimantan are represented by 65% (same percentage of the population) of 1973 values and (C) and (D) represented by 65% of the 1971 values.
2) For South Kalimantan, prefectural data of 1974 were summed up.
3) Estimate.

Thus, it may be considered that the farm land is expanded at a rate of 3.8% every year until 1978. If the farm land is to be expanded at this rate thereafter, the farm land area in the service area in 1983 is forecasted to be 682,000 hectares. On the other hand, the land area that can be appropriated for agriculture in the service area is 3,830,000 hectares (Table 3-10).

The labor force for agriculture in 1983, if it constitutes 75% of the labor force forecasted in paragraph 3-4-3 for agriculture, forestry and fishery, will then be 405,000. The farm land per farmer will, therefore, be 1.7 hectares. Presently, it is 1.24 hectares/farmer. Thus, the farmers are going to cultivate about 1.4 times farm land average. According to Pelita II, it is stated, as a transmigration policy, to give a land of 4 to 5 hectares or minimum 2 hectares to every household of immigrating farmer. When such figure is taken into consideration, the 1.7 hectares/man may be considered to be a reasonable figure. From the foregoing result of analysis, the rice will be self-supplied in the service area in 1983. Now assuming the per capita requirement of rice to be of the same level to that of the present at 0.269 ton/man and the yield rate of paddy as 2.5 tons/ha, the farm land required for self-supply of rice is

$$\frac{2,800,000 \times 0.269 \div 0.77}{2.5} = 391,000 \text{ ha.}$$

The paddy field is presently 305,000 hectares so that in 1983 about 1.28 times of the present area of paddy field will be required for self-supply. The required farm lands for the other agricultural products are calculated as follows:

For the foodstuff agricultural products other than rice

33,000 x 1.28 = 42,000 ha

For the estate agricultural products

38,000 x 1.28 = 46,000 ha

(provided the land area for rubber exported out of the service area is excluded).

In total, the required farm land for self-supply in 1983 will be 479,000 hectares. By deducting the farm land area for self-supply from the total farm land area, there is obtained a farm land area that can be appropriated for demand from the outside of the service area:

Farm land in the service area (682,000 ha)
– Farm land for self-supply (479,000 ha)
= Farm land appropirated for outside demand (203,000 ha)

The agricultrual products exported out of the service area in foreign trade as well as domestic trade are limited to rubber and little else presently. In 1983, it was estimated that rice and copra would be exported in a more or less amount respectively in addition to rubber. Because, they are cultivated presently in a relatively vast area in the service area and are apt to produce surplus. In Table 3-11 are represented the farm land area and yield rate of the respective outbound agricultural products.

a) Rubber – The rubber for export was estimated to be 90,000 tons as discussed in paragraph 3-5-2. To the other areas in the country, it was estimated that a total of 4,000 tons would be exported in domestic trade. For the land productivity, a value of 0.5 ton/ha has taken which seemed to be reasonable from the throughput of good farm land and past performance.

b) Rice – Rice is imported in domestic trade through the Banjarmasin Port presently, but it is in a condition adapted to yield surplus as stated in the foregoing.
Thus, an outbound domestic trade of 10,000 tons in rice was forecasted. For the yield rate, a value of 2.5 ton/ha was taken in consideration of the progress of intensive farming.

c) Coconut – Coconut has some throughput of export in domestic trade. It is also in a condition adapted to yield surplus in this area. Thus an outbound domestic trade of 10,000 tons was forecasted. Coconut yields copra cake and, additionally, active carbon from the shell and coarse cellulose from the outer shell. As the yield rate, 0.65 ton/ha was forecasted for the oil and 0.35 ton/ha for the other products.

In the foregoing projection of production, it is forecasted that the agricultural products have their yield rates improved respectively, and such forecasting is based on the assumption that the agricultural improvement now in progress will be carried out smoothly. For the paddy rice, it will be required that the intensive agriculture represented by INMAS and BIMAS is developed further. Improvement of the farm land through more extensive use of irrigation and introduction of fertilizers, mechanical force and agricultural chemicals must be made successively. Machines for processing will also be required. Requirements of these elements are calculated in trial as given below.

d) Fertilizer – It is hardly expectable that the application of fertilizer extends over the whole of the farm land for self-supply so that it is assumed here that the fertilizer is applied to 1/5 of the farm land for self-supply as well as paddy field designed for domestic trade. Then,

$$(479{,}000 + 5{,}000) \times 1/5 \times 0.25 = 24{,}000 \text{ tons}$$

If fertilization is made to 1/2 of the farm land designed for demand outside of the service area,

$$199{,}000 \times 1/2 \times 0.53 = 52{,}000 \text{ tons}$$

Table 3-10 Classification of Land Use in the Service Area

Central Kalimantan		South Kalimantan		Service Area
Land classification	Area (1000 ha)	Land classification	Area (1000 ha)	Area (1000 ha)
Estate	650	Tidal swamp area	200	
Dry paddy field	860	Ordinary swamp area	500	
Wet paddy field	1,310	Alluvial area	170	
		Alang-Alang grass area	230	
Total	2,820	Total	1,010	3,830

Note: Estimated from the land use maps attached to the following references:
1) Central Kalimantan Province, "Rencana Pembanguran Daerah Propinsi Kalimantan Tengah Tahun 1974/1979."
2) South Kalimantan Province, "Rencana Pembangunan Lima Tahun Kedua (Repelita II) 1975/75 – 1978/79."

Table 3-11 Agriculture for Foreign and Domestic Exports in 1983

Agricultural products	Area (1000 ha)	Yield rate (ton/ha)	Production (1000 tons)
Export, foreign			
Rubber	180	0.5	90
Export, domestic			
Rubber	8	0.5	4
Rice (paddy)	5	2.5	10 (13)
Coconut	10	1.0	10
Total	203		114

The fertilizer requirement is then 76,000 tons in total in 1983. Here, 0.25 ton/ha represent the rates of the fertilizer needed per hectare of paddy field and estate respectively.

e) Machines and other productive goods – It was considered that the machines and other productive goods would be required for those outbound agricultural products that had to be processed for 1/3 of the farm land. The productive materials imported in foreign trade as well as domestic trade in 1983 will be:

$$199{,}000 \times 1/3 \times 0.24 = 16{,}000 \text{ tons}$$

where 0.24 ton/ha represents the rate of production materials used per hectare for the estate agricultural products.

3) 2000

Assuming that the rate of 3.8% of the farm land reclamation forecasted for the service area during the period of Pelita II will be maintained until 2000, the area of farm land in 2000 will be 1,287,000 hectares. This area is about 1/3 of the arable land in the service are at 3,830,000 hectares. It could, therefore, be well developed from the point of view of land resource if the arable land should contain some places that would be qualitatively inappropriate for the farming. If it is assumed that the farmers constitute about 75% of the labor force of agriculture, forestry and fishery at such time, they will be 480,000 so that the farm land per former is 2.7 hectares. This figure is considered to be within the reasonable range from the farm land allocation plan designed for the transimmigration in Pelita II.

The area of paddy field for self-supply is, if the demand per capita remains unchanged from that at present while the yield is improved to 3.0 tons/ha,

$$\frac{4{,}500{,}000 \times 0.269 \div 0.77}{3.0} = 524{,}000 \text{ ha}$$

(1.72 times as much as that of the present)

The farm land for the foodstuff agricultural products other than rice for self-supply is

$$33{,}000 \times 1.72 = 57 \text{ thousand ha}$$

and the farm land for estate agricultural products for self-supply is

$$38{,}000 \times 1.72 = 62 \text{ thousand ha}$$

In total, the farm land for self-supply will be 643,000 hectares in 2000.

Then, the farm land that can be appropriated for the demand outside of the service area is

1,287,000 – 643,000 = 644 thousand ha

With respect to the agricultural products for demand outside of the service area, a summary of the farm land areas, yield rates and production is shown in Table 3-12.

a) Rubber – Rubber is an important export product presently. Its export price per ton is not much different from that of palm oil, but its land productivity is less than 1/5 of that of plam oil. Therefore, as a considerable growth would not be expectable in the future unless much efforts were exerted for land reclamation, it was forecasted that the export in 2000 would remain in the same level of 90,000 tons to that in 1983.

   For export in domestic trade, it was thought that an area of 40,000 hectares or 10% of 402,000 hectares assigned for the export in domestic trade would be appropriated for rubber. Further, it was thought that 1/2 of the production of rubber for export in domestic trade would not remain in the order of primary processing but be processed to footware and other rubber products. For the yield, a value of 0.7 ton/ha was taken as it would be improved to the prevailing level in the farm land along the Meratus Mountains.

b) Oil palm – Oil palm is a crop attracting attention recently in the tropical agriculture because of its high profitability and extensive demand. But there is little case of cultivation reported in Central and South Kalimantans except description of promoting the cultivation in Pelita II among the materials of Central Kalimantan. In the service area having vast area of plain, cultivation of oil palm will be conditioned favorably if irrigation and drainage are equipped properly.

   The target of 360,000 tons set for the estate agricultural products for export in foreign trade would be achieved by 90,000 tons of rubber and 270,000 tons of palm oil and palm kernel. The farm land of oil palm for such end is 64,000 hectares.

   For the farm land of oil palm for export in domestic trade, an area of 20,000 hectares or 5% of the farm land for domestic export was allocated.

c) Cassava – Cassava is not only used for food in the raw but exported as industrial products through a considerably high level of processing. Cassava has a throughput of cultivation in the service area and complies with the objective of industrialization of the regional development.

   Thus, with an objective of satisfying a greater part of the industrial products for exports with cassava, an area of 50,000 hectares was

Table 3-12 Agriculture for Exports in Foreign and Domestic Trades in 2000

Agricultural products including processed products	Area (1,000 ha)	Yield (ton/ha)	Production (1,000 ton)	Export, foreign (1,000 ton)	Export domestic (1,000 ton)
Mainly export in foreign trade					
Rubber	128	0.7	90	90	
Oil palm	64				
Palm oil		3.5	225	225	
Palm kernel		0.7	45	45	
Cassava	50				
Starch		1.6	80	80	
Feed, bullet type		3.2	160	160	
Feed, dry type		1.6	80		
Mainly export in domestic trade					
Paddy	282	3.0	844		
Rice					647
Rubber	40				
Rubber		0.7	14		14
Rubber products		0.7 x 0.6	8		8
Oil palm	20				
Palm oil		3.5	70		70
Palm kernel		0.7	14		14
Coconut	20				
Coconut oil		0.8	16		16
Active carbon, etc.		1.0	20	20	
Cassava	20				
Starch		1.6	32		32
Feed, bullet type		3.2	64		64
Feed, dry type		1.6	32		
Fruits	20	1.9	38		38
Total	644			612	903

allocated for the cassava for export. For the farm land of cassava for export in domestic trade, an area of 20,000 hectares or 5% of the farm land for export in domestic trade was allocated.

d) Rice – Among the agricultural products for export in domestic trade, rice is regarded to be most important as a food in Asia in the future. Presently, in the service area, about 80% of the farm land for self-supply is used for production of rice. In 2000, it was assumed that about 70% of the farm land for production for export in domestic trade or 282,000 hectares was allocated for rice.

For the yield rate, a value of 3.0 tons/ha was employed upon the assumption that the agricultural improvement would be carried out more energetically. A rate of 0.77 was taken for conversion from paddy to rice as in Pelita II. It was thought that the export in domestic trade would be made in the form of rice.

e) Coconut – For the farm land appropriated for coconut, an area of 20,000 hectares or 5% of the farm land allocated for production for export in domestic trade was taken. It was thought that the coconut oil would be exported in domestic trade and the active carbon in foreign trade.

f) Fruits – Fruits are the product of which freshness is particularly required among other agricultural products. They will come to have a competitive force in the markets on the other islands upon improvement of the distribution through provision of traffic infrastructures such as port, road and waterway. Thus, for the fruits, an area of 20,000 hectares or 5% of the farm land for production for export in domestic trade was allocated.

To achieve the production with high yield and processing, agricultural as well as industrial productive materials such as fertilizers and machines would be required.

g) Fertilizer – As the fertilizer for oil palm and rubber,

252,000 ha x 0.53 ton/ha = 134,000 tons,

and as the fertilizer for agricultural products other than oil palm and rubber,

1,035,000 ha x 0.9 x 0.25 = 232,000 tons,

or a total of 366,000 tons of fertilizer will be required in 2000. Here, in the latter case, it is assumed that the use of fertilizer in the estate for self-supply is at a rate of 90%.

h) Machines and other productive materials – When the agricultural products of primary processing are taken as an objective, 82,000 tons will be required:

$$342{,}000 \text{ ha} \times 0.24 \text{ ton/ha} = 82{,}000 \text{ tons}$$

(5) Forestry

1) Current status

Forestry is one of the important industries in this area and constitutes a principal part (72%) of the export in 1975. Concession for production of lumber is provided for the greater part of the area except the urban area and agricultural land and extends over an area of 91 km^2 (82% of the service area). A part of the log cut out is carried in use of water transportation through the rivers of Barito, Kahayan and Kapuas, their tributaries and canals connecting such rivers mainly to the Pulang Pisau Port and Banjarmasin Port and is exported in the form of log, while the other is processed into sawn timber and plywood in the course of log transportation to meet the demand in the service area and also for export in foreign as well as domestic trade from the said ports.

In 1975, the export of log was 1,352,000 m^3 and that of sawn timber was 35,000 tons, while the lumber exported in domestic trade was 180,000 tons. The consumption in the service area is estimated to have been about 400,000 m^3. Totaling these, the production of log in 1975 is estimated to have been 2,100,000 m^3. Classifying the log thus produced according to the application, the export in foreign trade was 67%; the export in the domestic trade was 14%; and the consumption in the service area was 19%.

For processing of the lumber, hand sawing is carried out at many places in the service area, while there are a number of large sawing mills constructed recently in the vicinity of Banjarmasin City, and modern sawing is carried out. There are also two plywood plants in Banjarmasin City, and their products are delivered out of the service area, if not in a large quantity.

2) 1983

a) Production — According to the materials of the Local Governments of Central Kalimantan and South Kalimantan, the forest land in the service area will be 64,900 km^2 in the future, and this figure does not include the land area which is forest at present but scheduled for use as agricultural land in the future. The area of forests to which forest concession is given presently in the service area is 91,000 km^2. If the lumber yield of forest is assumed to be 30 m^3/ha, the storage will be

$$91{,}000 \times 100 \times 30 = 273 \text{ million } m^3$$

If the cutting is made at a cycle of 60 years with a view to stable utilization of the forest resource in the future, the limit of annual cutting will be

$$273,000,000 \div 60 = 4,550,000 \text{ m}^3/\text{year}$$

According to the result of the survey by the Japanese survey team in 1971, it is estimated that about 2,600,000 m^3 of lumber can be cut in the catchment area of the Barito River annually. While the method of forecasting is different, the foregoing value is not much different from this figure, if the difference of the areas in discussion is taken into consideration.

b) Consumption – On the other hand, the log to be exported amounts to 83,000,000 dollars as discussed in paragraph 3-5-2. Thus,

$$\$83,000,000 \div \$36.4/\text{m}^3 = 2,280,000 \text{ m}^3$$

Where the unit price is according to the throughput of export in 1975.

The processed timber to be exported amounts to 32,000,000 dollars as discussed in paragraph 3-5-2. Thus,

$$\$32,000,000 \div \$89.1/\text{m}^3 = 360,000 \text{ tons}$$

or, when converted to the amount of log,

$$360,000 \text{ tons} \div 0.5 \text{ ton/m}^3 = 720,000 \text{ m}^3$$

The domestic demand increases by 70,000 m^3 every year from 1974 to 1978 according to the plan of Central Kalimantan. Then, with the year of 1978 taken as the base, the domestic demand in 1983 will be

$$600,000 + 700,000 \times 5 = 950,000 \text{ m}^3$$

or, when converted to the processed timber,

$$950,000 \times 0.6 = 570,000 \text{ tons}$$

As the demand in the service area is 160,000 tons (60,000 tons x 2.6; 60,000 tons is the demand in the service area in 1975 and 2.6 is the mean value of the GDP multiplication at 2.0 and the multiplication of the construction industry at 3.2), the processed timber to be exported out of the service area in the domestic trade is 410,000 tons.

From the foregoing estimation, the consumption of log is

$$2,280,000 + 720,000 + 950,000 = 3,950,000 \text{ m}^3,$$

which is well within the limit of cutting specified in subparagraph a) and is, therefore, appropriate.

c) Distribution — Presently, a part of log produced along the Kahayan River is exported from the Pulang Pisau Port, while another part thereof is carried to the Banjarmasin Port through the canals and is exported from this port. But, in the future, sharing of the functions between the ports will be considered so that for the sake of estimation of the port traffic, all of the log produced along the Kahayan River is assumed to be exported from Pulang Pisau Port. Thus the log loaded at Banjarmasin Port will be

Export in foreign trade	
Log	1,000,000 tons (1,280,000 m^3)
Processed timber	360,000 tons
Export in domestic trade	
Processed timber	410,000 tons
Total	1,770,000 tons

3) 2000

a) Production — Production of the log is suppressed to 4,550,000 m^3/year.

b) Consumption — The domestic demand is, when the year of 1978 is taken as the base,

$$600{,}000 \text{ m}^3 + 70{,}000 \text{ m}^3/\text{year} \times 22 \text{ years} = 2{,}140{,}000 \text{ m}^3$$

or in terms of the processed timber

$$2{,}140{,}000 \text{ m}^3 \times 0.6 \text{ ton/m}^3 = 1{,}240{,}000 \text{ tons}$$

Assuming that the demand in the service area increases in accordance with the growth of GDP,

$$60{,}000 \text{ tons} \times 7.3 = 440{,}000 \text{ tons}$$

The processed timber to be appropriated for export out of the service area in the domestic trade is

$$1{,}240{,}000 - 440{,}000 = 800{,}000 \text{ tons}$$

The log to be appropriated for export in foreign trade is

$$4{,}550{,}000 - 2{,}140{,}000 = 2{,}410{,}000 \text{ m}^3$$

c) Distribution — The export from the Pulang Pisau Port is to handle the log cut out of the catchment area of the Kahayan River and shall be 1,000,000 m^3. Then, the export from the Banjarmasin Port will be

$$2{,}410{,}00 - 1{,}000{,}000 = 1{,}410{,}000 \text{ m}^3$$

If this volume is wholly processed for export,

$$1{,}410{,}000 \times 0.5 = 700{,}000 \text{ tons}$$

(6) Power electricity

Present Situation

The power distribution system of PLN (State owned enterprise of Electricity) in the service area of Banjarmasin Port is divided roughly into the following three categories.

1) Banjarmasin system – This is the system which receives the electricity from the Riam Kanan power plant and which has a sub-station at Banjarbaru and a sub-station at Banjarmasin. The power-generating capacity as of 1975 is 20,000 KW by hydraulic generation and 2,400 KW by reserve thermal generation. A 10,000 KW hydraulic power plant is planned to be added soon to increase the present capacity up to a 30,000 KW capacity. The power transmission capacity is 10 MW. The actual sales of power in 1975 were 27,000 MWH.

2) Palangkaraya system – There is a thermal power plant at Palangkaraya. The actual sales of power in 1974 were 600 MWH.

3) System other than 1) and 2)

It is the Banjarmasin system in 1) which is related particularly to the Banjarmasin Port development. The power generation and sales of power of the Banjarmasin system in 1975 were 38,800 MWH hydraulic, 0 thermal and 27,000 MWH, respectively. Therefore, the power generation loss was 32.9% and the utilization coefficient was 22%. Since the power is distributed to the three cities of Banjarmasin, Banjarbaru and Martapura, the power per capita consumption was 66 KWH (population: 412,000). The power consumption by usage in this area in 1975 was 45% for residence use, 7% for commercial use, 10% for governmental use, 25% for big consumers and 13% for other uses. It is noted that the share of the big consumers is increasing recently.

Future Forecast

The future prospect for the demand and supply of power in Banjarmasin system as follows.

The sales of power for 1978 in PELITA II is assumed to be 43,500 MWH. Since the power is supplied to the 450,000 population, the percapita consumption is 97 KWH. Considering the nationwide increase in power output (18%/year) and the nationwide increase in population (2.4%/year), both of which are assumed in PELITA II, the increase in power output per capita during PELITA II period is about

15%/year. Considering that the Banjarmasin system's power consumption would increase at this rate, the per capita power consumption in 1983 is assumed to be 195 KWH/capita. Assuming that the power is still supplied to the same area as at present, the population in the same area will be 520,000. Therefore, the power consumption in 1983 will reach

$$195 \times 520,000 = 100,000 \text{ MWH}$$

Meanwhile, the capacity of the Riam Kanan power plant is, after its expansion plan, 30 MW. Assuming that the power generation loss is 20% and that the utilization coefficient is 60%, the power supply capacity will be

$$30 \times (1 - 0.2) \times 8,760 \times 0.6 = 130,000 \text{ MWH.}$$

Therefore, based on this calculation, there is still room in the capacity of the power plant. However, as the industrial location promotes, it is certainly expected that there would be a big demand exceeding this capacity. Therefore, around 1983, the construction of a new power plant would be required.

Assuming that a 50 MW power plant is to be built and that the utilization coefficient is 60%, the annual power output would be

$$50 \times 8,760 \times 0.6 = 260,000 \text{ MWH.}$$

Assuming that the power plant is a thermal one using the heavy oil as fuel, the annual oil demand would be

$$260,000/4,300 = 60,000 \text{ Kl} \doteqdot 60,000 \text{ tons,}$$

where 4,300 (KWH/Kl) is the average oil to power conversion factor.

3-5. Port Traffic Forecast

3-5-1. General

In this paragraph, the outlook is described with regard to the port tonnage traffic and the passenger traffic.

Summary of the forecast result of the port tonnage traffice is shown on Table 3-13 and Fig. 3-2.

With respect to methodology of the port tonnage traffic forecast and the itemized details of each commodity, explanation will be given in the following sections.Then, thus obtained itemized freight volume will be classified by the berthing facilities and the type of commodity for the convenience of port facility planning.

Table 3-13 Forecast of Traffic through Banjarmasin Port

Item	1975 (1,000 ton)	1983 (1,000 ton)	2000 (1,000 ton)	1983/1975	2000/1975
Export	658	1,480	2,300	2.2	3.5
Import	17	70	240	4.1	14.1
Outbound domestic trade	220	500	1,800	2.3	8.2
Inbound domestic trade	291	760	3,200	2.6	11.0
Total	1,186	2,810	7,540	2.4	6.4

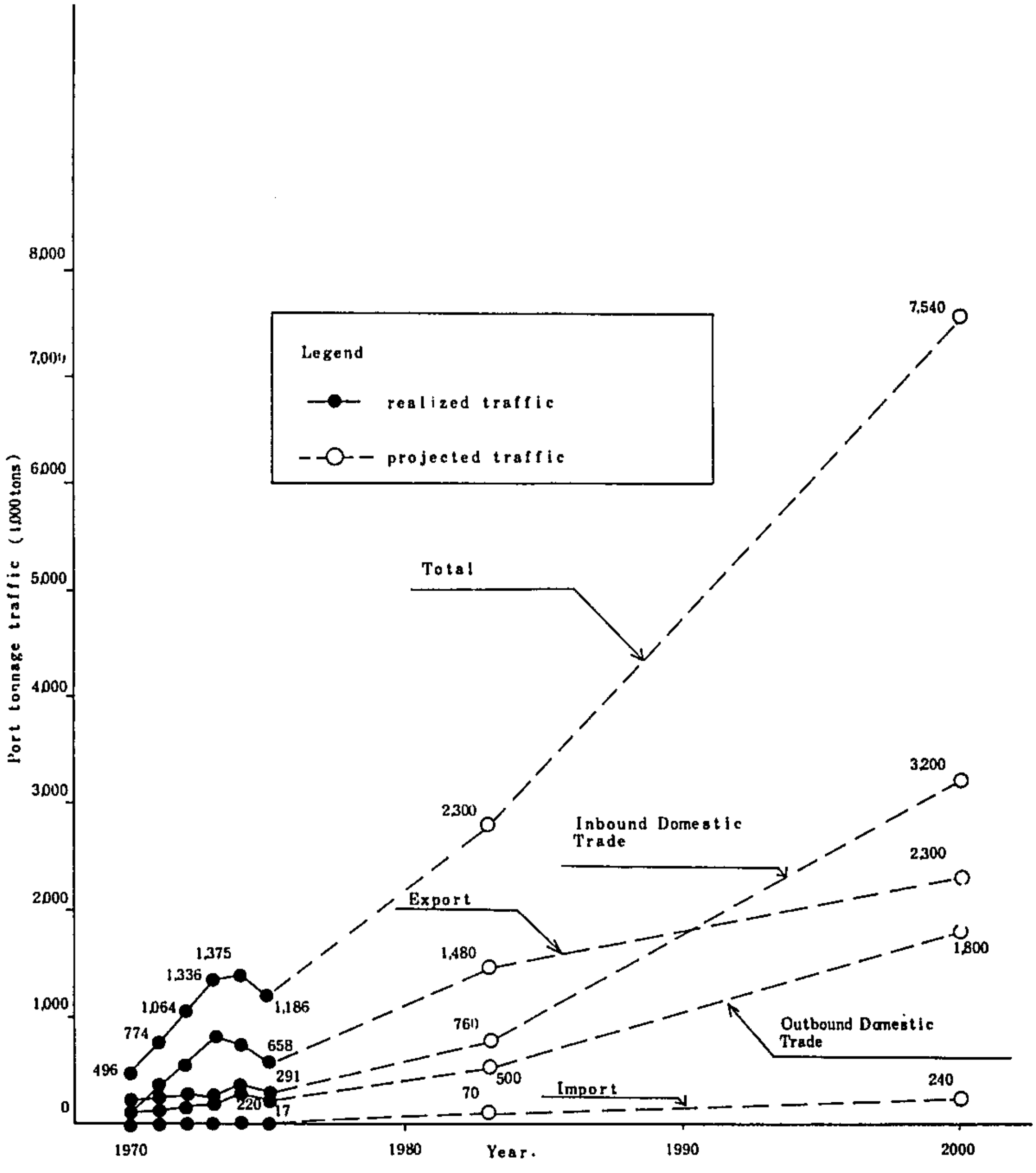


Fig. 3-2 Forecast of Traffic through Banjarmasin Port

3-5-2. Export

1975

In the service area of the Banjarmasin Port in future, three ports are included; namely Banjarmasin, Kapuas and Pulang Pisau. The export records of these ports are shown on Table 3-14 in terms of quantity and on Table 3-15, value.

Referring to Table 3-14, export volume of the Service Area in 1975 amounts to 1,141 thousand tons. Main items consist of logs, sawn timber and rubber and the participation of each item in the export is 92.4%, 3.1% and 3.4%, respectively. The summation of logs and sawn timber amounts to 95.5% so that the Service Area may be considered to be specialized to lumber. With regard to the export in the service area, Banjarmasin Port participates 57.7% and its itemized structure is similar to that of whole Service Area. Kapuas Port occupies only 2.3% of the total amount in terms of volume, but the proportion of lumber is small compared with that of the overall Service Area. Pulang Pisau Port participates 40% of the export in the Service Area and is completely specialized to lumber.

Referring to Table 3-15, the export in the Service Area is 69 million dollars in value. It consists of 69.4% logs, 4.4% sawn timber, 23.8% rubber and 2.4% others. Proportion of lumber amounts to 73.8% which is obtained by summing up those of logs and sawn timber, and this figure is lower than the proportion of lumber in volume, 95.5%. Rubber participates 23.8% in value of the export of the Service Area. This figure is considerably higher than that in volume, 3.4% so that it indicates the importance of rubber in the territorial economy.

The export at Banjarmasin Port participates 62.5% in value of that of the Service Area. This figure is somewhat larger than that in quantity. The proportions of Kauas and Pulang Pisau Ports are 7.8% and 29.7%, respectively, and indicate the high contribution of Kapuas Port in value. With regard to itemized structure, the feature of each port is almost identical to that in volume as described above.

1983

The forecast of export volume of Banjarmasin Port is made in the following procedures;

(1) Estimation of export value in the Service Area

(2) Estimation of export value by commodity

(3) Calculation of export volume by commodity and its allocation to ports

The procedures of the forecast are as follows:

(1) Estimation of export value in the Service Area

Table 3-14 Export Volume of Ports in the Service Area in 1975 in Quantity

	Commodities	Banjarmasin	Kapuas	Pulang Pisau	Total Export
Tonnage,	Logs	606	4	445	1,055
1,000 tons		(777)	(5)	(570)	(1,352)
(1,000 m^3)	Sawn timber	16	8	11	35
	Rubber	27	11	-	38
	Others	9	4	-	13
	Total	658	27	456	1,141
Composition	Logs	53.1	0.3	39.0	92.4
(%)	Sawn timber	1.4	0.7	1.0	3.1
	Rubber	2.4	1.0	-	3.4
	Others	0.8	0.3	-	1.1
	Total	57.7	2.3	40.0	100.0

Note: Summed up the figures in the following source

Source: Biro Pusat Statistik, "Ekspor, Menurut Jenis Barang Negeri Tujuan dan Pelabuhan Ekspor, 1975", April, 1975

Table 3-15 Export Value of Ports in the Service Area in 1975

	Commodities	Banjarmasin	Kapuas	Pulang Pisau	Total export
Value in	Logs	28,301	186	19,239	47,726
FOB price	Sawn timber	1,462	575	962	2,999
(1,000 US$)	Rubber	11;869	4,499	-	16,368
	Others	1,354	101	188	1,643
	Total	42,986	5,361	20,389	68,736
Composition	Logs	41.1	0.3	28.0	69.4
(%)	Sawn timber	2.1	0.9	1.4	4.4
	Rubber	17.3	6.5	-	23.8
	Others	2.0	0.1	0.3	2.4
	Total	62.5	7.8	29.7	100.0

Note: Summed up the figures in the following source

Source: Biro Pusat Statistik, "Ekspor, Menurut Jenis Barang Negeri Tujuan dan Pelabuhan Ekspor, 1975, April, 1975

The growth rate of the national export value except for petroleum is 11.4% per annum according to the plan of Pelita II. This figure is adopted for the growth rate of the export value in the Service Area. Then the export value in 1983 is estimated at;

$$69 \times 1.114^8 = 160 \text{ million dollars}$$

The ratio of this export value against GDP is 0.27. On the other hand, the same ratio in 1973 is approximately 0.3 so that the ratio in 1983 is slightly less, but it may be considered materially identical to the current trend.

(2) Estimation of export value by commodity in the Service Area

With regard to year after the period of Pelita II, the IBRD report* forecast the export value by commodity up to 1985. According to the report, the export value except for petroleum is estimated to increase up to approximately 5 times in the period of 10 years from 1975 to 1985. With regard to commodity composition, the proportion of manufactured products is estimated to grow rapidly but it is also forecasted that the proportion of minerals will stay stable and that of agricultural and other miscellaneous products will decrease. However, rapid growth is expected in absolute volume for each commodity.

Future export from the Service Area is considered to reflect the territorial features with regard to the export and to comply with the national policy and target of the export in Indonesia. First, we presume that the export commodities of the Service Area in 1983 will consist of logs, sawn timber, rubber, etc., similarly to the situation at the present time. Also the participations of these commodities to the total export is presumed as shown on Table 3-16 in consideration of the change of export commodity composition up to 1985 in accordance with the IBRD report.

Then the export value in the Service Area as obtained in the above is allocated to each commodity in that proportion, thus determining the target of the export value by commodity.

(3) Calculation of export volume by commodity and its allocation to ports

The export quantity by commodity is obtained by dividing the export value by the unit price. As for the unit price, FOB price in 1975 is adopted.

In 1983, port facilities of Banjarmasin are expected to be much improved in 1983 together with the improvement of the traffic infrastructures e.g. canals, roads, etc. to Banjarmasin, so that it is presumed that the whole export in the Service Area will be made exclusively through Banjarmasin Port except for logs yielded in Kahayan River catchment area. As described in 3-4, it is presumed that logs yielded in Kahayan River catchment area for export purposes will be 1,000 thousand cubic meters and this will be allocated to Pulang Pisau Port.

*IBRD, "Indonesia Development Prospects and Needs, Basic Economic Report," April 15, 1975.

Table 3-16 Forecast of Export Value in the Service Area

Commodities	Value (mln. US$)			Composition (%)		
	1975	1983	2000	1975	1983	2000
Rubber and other estate crops	16	40	150	24	25	25
Logs	48	83	36	69	52	6
Fish & cattles	-	-	42	-	-	4
Minerals	-	-	60	-	-	10
Manufactures	3	32	288	4	20	48
Miscellaneous	2	5	24	3	3	4
Total	69	160	600	100	100	100

In conclusion, the export of Banjarmasin Port in 1983 is estimated at 1,480 thousand tons in total as shown on Table 3-17.

2000

The export volume forecast of Banjarmasin in 2000 is made in the same procedures as that in 1983.

(1) Estimation of export value in the Service Area

On the presumption that the export value of the Service Area in 2000 is approximately same as that in 1983 in terms of the ratio against GDP, the estimation is made at 600 million dollars.

(2) Estimation of export value by commodity in the Service Area

With regard to itemized export value in 2000, the commodity composition is first estimated, similarly to the case in 1983, taking the IBRD report into consideration. Then the export value is allocated based on this composition. However, with regard to lumber, modification is made in the process of composition estimation, in order to reflect the restriction due to resource preservation.

1) Rubber and other agricultural products

This is presumed to keep 25% of proportion which is similar to that of the present time.

2) Logs

It is presumed that the export of logs will be made still exclusively through Pulang Pisau Port and that other logs will be exported after being processed.

Unit price of logs is presumed to stay at the same level as that in 1975, so that the log export value is estimated at 36 million dollars. Consequently, the proportion of the log export with respect to the export of the service Area becomes 6%.

3) Fish and cattles

Although the export of fish and cattles were not predominant, a large volume of fish and cattle output is expected, so that they are presumed to be included in the export commodities with a composition of 7%.

4) Minerals

Although the mineral export is not made for the moment through the three ports in the Service Area, deposit of iron ore, coal, etc. has been already confirmed so that there is a great possibility of new mineral output depending

Table 3-17 Forecast of Export in Banjarmasin Port

1,000 tons (1,000 m^3)

Commodities	1975	1983	2000
Logs	606 (777)	1,000 (1,280)	-
Processed timber	16	360	700
Rubber	27	90	90
Processed agricultural products			530
(Palm oil)			(225)
(Palm kernel)			(45)
(Starch)			(80)
(Feed)			(160)
(Active carbon)			(20)
Fish & cattle products			20
Minerals			800
Miscellaneous	9	30	160
Total	658	1,480	2,300

upon the future scientific survey. If it is discovered, it may constitute a profitable commodity for export. Therefore it is presumed that minerals will participate in export by 10% in 2000, by taking the national trend of export into consideration.

5) Industrial products

To achieve the national export target, approximately, one half of the total export in 2000 must be borne by industrial products in the Service Area. As for the prospective export commodities, processed forest products and processed agricultural products are considered promising. It is presumed that the industrial products will participate in export by 48% in the Service Area. This target figure will be achievable, according to the microscopic accumulation in volume, on condition that the active efforts is made to promote industrial growth (3-4).

6) Other miscellaneous products

Similarly to the case of national export target, 4% is employed, which is slightly higher than that of the present time.

Consequently, the itemized export value in 2000 in the Service Area can be estimated as shown on Table 3-16.

(3) Estimation of export volume by commodity and its allocation to ports

At the time of the extimation of the export volume by commodity, unit price is presumed by commodity group as shown on Table 3-18 and then, the export value obtained in the above is converted to volume.

Among the export volume of commodity groups thus obtained, forest products, agricultural products and their processed products are checked and subdivided from the other point of view, as described in 3-4.

Among the export from the service area of the port, log output in Kahayam River catchment area is presumed to be exported, in its original form, from Pulang Pisau Port. All commodities, other than 1,000 thousand cubic meters logs, are presumed to be exported exclusively from Banjarmasin Port. Consequently, the export volume through Banjarmasin in 2000 is estimated at 2,300 thousand tons as shown on Table 3-17.

3-5-3. Import

On estimation of import quantities in the future, firstly making estimate of the quantities of the materials to be brought into the service area, and thence the method is taken to classify into import and inbound domestic trade. The details of the estimation is stipulated in 3-5-5 as hereafter mentioned, hereunder is a simple description of the result.

Table 3-18 Forecast of Export by Commodity in 2000

Commodity group	Value (mln. US$)	Unit price US$/ton	Tonnage (1,000 tons)	Commodities presumed
Rubber and other estate crops	150	400	360	Rubber, palm oil, palm kernel
Logs	36	36	1,000	Logs
Fish and cattles	42	2,000	20	Shrimp, Prawn, meat & leather
Minerals	60	75	800	Crude minerals
Manufactures	288	300	960	Sawn timber, plywood, housing materials, starch, feed, etc.
Miscellaneous	24	150	160	
Total	600	---	3,300	——

Note: Unit price is determined by presuming actual commodity by commodity group

1975

The Import quantity at Banjarmasin Port in the year of 1975 amounted to 17,000 tons, which only occupies by 1.4% of port tonnage traffice at the Banjarmasin Port. The import commodity consists of the production materials and the construction materials etc. (Table 3-19).

1983 and 200

The result of the estimation is given in Table 3-19. The quantities will amount to 70,000 tons in 1983 and 240,000 tons in 2000.

The import commodity covers not only the production materials, the construction materials and miscellaneous goods that were handled in 1975, but such new commodity as food stuffs is also included.

It is due to the following consideration that such kinds of goods as are once imported into at the Port of Surabaya and of Tg. Priok to be carried thence into the Banjarmasin Port in the form of domestic commodity, shall directly be imported into this port, in line with the improvement of the port facilities.

3-5-4. Outbound domestic trade

1975

The outbound domestic trade of Banjarmasin was 220 thousand tons. Among this, 180 thousand tons consisted of lumber and the balance, agricultural products, fish and cattle products and handicraft products.

1983

The forecast of the outbound domestic trade volume in 1983 is made by both ways where the estimation is derived macroscopically from economic indices and where it is determined by accumulation of each commodity figure.

In the former method, the relationship with GDP of the Service Area is used and the outbound domestic trade in 1983 is estimated at 500 thousand tons.

In the latter method, the following procedures are applied to.

(1) Processed timber

As described in 3-4-4 (4) Forestry, the available volume to the outbound domestic trade is obtained by subtracting the consumption of the Service Area from the lumber volume for national market, resulting in 410 thousand tons.

(2) Rice, copra, rubber

Table 3-19 Forecast of Imports

Commodities	1975	1983	2000
Food	-	28	50
Production Materials	7	8	100
(Fertilizers)	(1)	(-)	(-)
Machine and other production materials	(6)	(8)	(100)
Construction materials	8	21	56
(Steel)	(5)	(21)	(56)
(Asphalt)	(3)	(-)	(-)
Miscellaneous	2	13	34
Total	17	70	240

As described in 3-4-4 (4) Agriculture, the estimation is made at 10 thousand tons of rice, 10 thousand tons of copra and 4 thousand tons of rubber. With regard to other agricultural products, 4 thousand tons are estimated on the presumption that the same growth rate as GDP in the agriculture, forestry and fishery will be applicable.

(3) Fish

The trade of fish to domestic market in 1983 is estimated at 10 thousand tons on the presumption that its growth rate is same as that of agriculture and fishery.

(4) Miscellaneous

The trade of handicraft products to outbound domestic market in 1983 is estimated at 20 thousand tons on the presumption that it grows at the same rate as that of industrial GDP. Other products are estimated at 32 thousand tons by applying the growth rate of population.

Thus, the trade volume with respect to commodity to outbound domestic market is obtained as shown on Table 3-20.

2000

The forecast of the trade volume to outbound domestic market in 2000 is made by both macroscopic and accumulating ways.

In the former, the estimation is made on the presumption that the growth rates of the outbound domestic trade and GDP will become identical in 2000. Consequently, it is estimated at 1,800 thousand tons.

In the latter, the following procedures are applied to.

1) Processed timber

As described in 3-4-4 (5) Forestry, it is estimated at 800 thousand tons.

2) Agricultural products and processed agricultural products

As described in 3-4-4 (4) Agriculture, the following figures are obtained: 647 thousand tons of rice, 218 thousand tons of processed agricultural products (palm oil and palm kernel, copra, starch and feed, rubber and rubber products) and 38 thousand tons of fruits.

3) Fish

The trade of fish to outbound domestic market in 2000 is presumed to grow at the same rate as that of GDP of agriculture and fishery so that 26 thousand tons is obtained.

4) Micellaneous

It is presumed that handicraft products will stay at low growth rate after 1983, together with the development of other industrial products, so that it is estimated at 24 thousand tons. Others are estimated at 50 thousand tons on the presumption that its growth rate is identical to that of population.

Thus, the trade volume by commodity to outbound domestic market is obtained as shown on Table 3-20.

3-5-5. Inbound domestic Trade

It was difficult for the large vessels to directly call into the Port of Banjarmasin due to the shallowness of the water of the mouth of the river Barito. It can be considered that the inbound domestic trade includes the cargoes that should have directly been imported into the Port of Banjarmasin. At the forecast of this paragraph, firstly making forecast of the cargoes that shall be delivered to the service area, and thence such method is taken as to divide it into import and inbound domestic trade.

1975

The cargoes of inbound domestic trade at the Port of Banjarmasin in 1975 amounted to 136,000 tons of petroleum, and 155,000 tons of other cargoes than petroleum, making 291,000 tons in total.

The composition of the commodities and its tonnages of the cargoes are as shown in Table 3-21, next to petroleum, food stuffs, construction materials and miscellaneous goods are the main commodities. Table 3-21 is not the statistics itself. The miscellaneous goods that are contained in the statistics occupies by 40% of the inbound domestic trade, which are inconvenient to the forecast for the future, so that adjustment was made by the other data and from the view of the investigation of this territory. The figure of the result is given in Table 3-21.

Among the inbound domestic trade, those that can be considered as the goods made in foreign country, are forecasted by commodity to make the total of 44,000 tons, which amount to by 28% of the inbound domestic trade.

Summing up inbound domestic trade and import to make total of 172,000 tons, out of which the goods made in foreign country are forecasted to amount to 61,000 tons. The proportion of the goods made in foreign country is estimated to be by 35% of the cargoes that are brought into the service area. These cargoes would have been under the import categories, should the port facilities of Banjarmasin have been sufficient enough to accommodate large vessel call.

1983

(1) Petroleum

Table 3-20 Forecast of Outbound Domestic Trade

1,000 tons

Commodities	1975	1983	2000
Processed timber	180	410	800
Rice	4	10	647
Processed agricultural products	4	18	218
Palm oil			(70)
Palm karnel			(14)
Copra		(10)	(16)
Starch			(32)
Feed			(64)
Rubber	(2)	(4)	(14)
(Rubber products)			(8)
Others	(2)	(4)	
Fish	6	10	26
Fruits	-	-	38
Micellaneous	26	52	74
(Handicrafts)	(5)	(20)	(24)
(Others)	(21)	(32)	(50)
Total	220	500	1,800

Table 3-21 Estimate of Classification of Discharged Traffic, 1975

Commodity group	Import (1) (1,000 tons)	Inbound domestic trade (2) (1,000 tons)	Made in Indonesia (3) (1,000 tons)	Made in Foreign Country (4) (1,000 tons)	(5) = (4)/(2) (%)	Total inbound traffic (6)=(1)+(2) (1,000 tons)	Possible direct import (7)=(1)+(4) (1,000 tons)	Percentage Composition (8)=(7)/(6) (%)
Food	-	87	62	25	29	87	25	29
Production materials	7	8	1	7	(90)	15	14	93
Fertilizers	(1)	(1)		(1)	(80)	(2)	(2)	(100)
Machine & other production materials	(6)	(7)	(1)	(6)	(90)	(13)	(12)	(92)
Construction Materials	8	20	14	6	30	28	14	50
Steel	(5)					(5)	(5)	(100)
Cement		(12)	(6)	(6)	(50)	(12)	(6)	(50)
Asphalt	(3)					(3)	(3)	(100)
Housing Materials		(4)	(4)	(0)	(0)	(4)	(0)	(-)
Others		(4)	(4)	(0)	(0)	(4)	(0)	(-)
Miscellaneous	2	40	34	6	(15)	42	8	(19)
Total excluding oil	17	155	111	44	28	172	61	35
Oil	-	136	136	-	-	136	-	-
Total	17	291	247	44	-	308	61	-

On the assumption that it will grow at the rate of 10% as is planned in Pelita II, the quantities that shall be brought in shall amount to 290,000 tons in 1983.

(2) Food stuffs

Among 87,000 tons of food stuffs that were delivered in 1975, 83,000 tons excluding rice, consist of such food stuffs as salt, sugar, wheat flour, and vegetables that shall give varieties to the dietary life. It can be considered that the per capita consumption shall increase in line with the growth of income. The per capita consumption in 1983, it was to be forecasted, shall increase by 1.3 times of the present consumption. The quantities of the food stuffs to be brought into;

Food stuffs exclusive of rice x population growth x 1.3

= 83,000 x 1.3 x 1.3 = 140,000 tons

Out of which, 20% shall be imported, amounting to 28,000 tons, the remaining is to be estimated as inbound domestic trade.

(3) production materials

1) Fertilizer

By the estimation, given in 3-4-4 (4) Agriculture, the quantities of fertilizer that shall be carried into in 1983 shall amount to 76,000 tons. The fertilizer demand in total Indonesia in 1978 is estimated at 3,187,000 tons whilst the demand for fertilizer is planned at 2,448,000 tons in Palita II, and production is recently adjusted at 2,765,000 tons. In other words, the domestic production of fertilizer is rapidly increasing, and the export of fertilizer to ASEAN countries is envisaged in the year of 1983. Therefore, 76,000 tons of fertilizer are classified under inbound domestic trade.

2) Machinery and other production materials

As was estimated in 3-4-4 (4) Agriculture, the quantities of machinery and other production materials that shall be brought into in 1983 shall amount to 16,000 tons, out of which, 50% should be considered to be from import, so classified under 8,000 tons of import, and 8,000 tons of inbound domestic trade.

(4) Construction materials

In order to promote the development of the service area in the future, the construction works for the improvement of the infrastructure should be undertaken, in preceding to, and/or at the same time with the development of the industry. The present condition for the improvement of the infrastructure is not necessarily be sufficient: for example, the ratio of pavement, 56% in the national roads, 25% in the state roads. It is the big target in the improvement of roads at Pelita II to try increase the pavement ratio. In order to construct the facilities of such higher quality, it is considered that the necessary quantities for unit construction cost shall be more required than that of present. The necessary quantities for the construction materials in 1983 shall therefore amount to 180,000 tons, in view of the increase by 2 times of the growth rate of the construction industry GDP.

The breakdown of the commodities of the construction materials is estimated in reference to the composition of commodities in 1975.

The majority of the construction materials shall domestically be supplied, it is considered, however, that the supply of iron and steel must depend upon the import, 50% of the necessary quantities, 21,000 tons are classified under import. The remaining 21,000 tons shall once be imported to Java Island where industries are gathered to have them fabricated to a certain extent, and thence these shall be brought into the Port of Banjarmasin in the form of inbound domestic trade.

(5) Miscellaneous goods

The miscellaneous goods that shall be delivered consist of consumption goods, inclusive of endurance consumption goods. As the income increases, so the per capita consumption shall in general increase more than the income. Taking the increase rate of miscellaneous goods as 1.5 times of GDP, it is forecasted that the quantities that shall be brought into in 1983 shall amounts to 128 000 tons. Out of which, 10% would be imported, it is so forecasted that import amount to 13,000 tons, inbound domestic trade 115,000 tons.

Making use of the correlation with GDP, if the forecast is macroscopically made on the import quantity for 1983, excluding petroleum, it would amount to 40,000 tons, inbound domestic trade amounts to 500,000 tons, making 540,000 tons in total. This macroscopically forecasted cargoes correspond, in total quantities, to that of the piling up method as herein above conducted. The breakdown between import and inbound domestic trade shall make a difference of 30,000 tons, this difference of which can be considered as the volume of cargoes that shall be transferred from the inbound domestic trade to the import by the improvement of Port of Banjarmasin.

2000

(1) Petroleum

The quantities of petroleum in 2000 that shall be brought in as in planned in Pelita II, would amount to 1,500,000 tons, with a yearly increase of 10%.

(2) Food stuff

It is to be considered that more varieties for dietary life shall be introduced in 2000, compared with that of 1983, and the quantities that shall be brought in would amount to 249,000 tons, by 1.5 times of the population growth. Out of which 20% shall be imported, import amounts to 50,000 tons, inbound domestic trade 199,000 tons.

(3) Production material

1) Fertilizer

The forecase given in 3-4-4 (4) Agriculture shows that the brought in quantities of fertilizer in 2000 would amount to 366,000 tons.

The total quantities shall be supplied from the introduction of the domestic production.

2) Machinery and other production materials

According to the forecast given in 3-4-4 (4) Agriculture, the brought in quantities of machinery and other production materials in 2000 would amount to 286,000 tons. Furthermore, it is forecasted that 50,000 tons of machinery etc. shall be brought into for the repair of vessels and for the development of mines. Out of which, 30% shall be imported, it is estimated that import amounts to 100,000 tons, inbound domestic trade 236,000 tons.

(4) Construction materials

Same as in 1983, if it is considered that construction material shall be required in proportion to the increase by 2 times of the growth rate of construction industry GDP, the necessary quantities for construction materials in 2000 would amount to 806,000 tons. With reference to the composition of commodities in 1975, if the estimation is made on the necessary quantities for the construction materials in 2000, by commodity, iron amounts to 185,000 tons, cement 354,000 tons, asphalt 89,000 tons, building materials 113,000 tons and other 65,000 tons.

Out of which, as it is presumed that total quantities of cement and a part of the building materials shall be supplied by the industry to be established in this area, brought in quantities would amount to 376,000 tons.

As to iron and steel, it is to be considered that 30% many imported, import would amount to 56,000 tons, inbound domestic trade 129,000 tons. The other construction materials that shall be brought in are all treated in the inbound domestic trade.

(5) Miscellaneous goods

The living standard shall be leveled up, it is assumed that the growth rate of the brought in miscellaneous goods shall be by 2 times of the growth of GDP. The brought in quantities of miscellaneous goods in 2000 are forecasted to be of 613,000 tons. Out of which, proportion of import, similar to that of machinery and iron and steel, would be by 60% of the shares in 1983, so that it is forecasted by 6%. Therefore, it is forecasted that import amounts to 34,000 tons, inbound domestic trade 579,000 tons.

As is above mentioned, it is forecasted that import quantities in 2000, excluding petroleum, amount to 240,000 tons inbound domestic trade quantities 1,700,000 tons. The proportion of import to the total brought in quantities shall slightly decrease. It is due to the result of such consideration that the proportion of procurement of the commodities in domestic market shall increase, in line with the progress toward the industrialization of total Indonesia.

Further, if it is assumed that the quantities of both import and inbound domestic trade shall increase at the same growth rate of GDP, it is forecasted that import amount to 140,000 tons, inbound domestic trade 1,800,000 tons making 1,940,000 tons in total in 2000.

This figure corresponds in total quantities to the result of piling up forecast method, making difference of 100,000 tons by the classification of import and inbound domestic trade. This difference, it can be said, shows the transfer from the inbound domestic trade to the import to be made, in connection with the improvement of port facilities at Banjarmasin.

Table 3-22 shows the summary of the results of the above-mentioned.

3-5-6. Classification of Port Tonnage Traffic by Type of Commodity

Table 3-23 shows the classification by type of commodity and by berthing facility of port tonnage traffic, that has been forcasted in from 3-5-2 to 3-5-5. This table, having been made, taking into account the nature and volume and distribution of the cargoes, shall constitute the key for making up the plan for berthing facilities.

3-5-7. Passengers

Present

The number of the passengers through the Port of Banjarmasin in 1975, is of outgoing 6,118 persons, incoming 4,710 persons, making 10,828 persons in total. The recent trend of the incoming and outgoing passengers shows the slight increase in 4 years between 1970 to 1973, and the decline thereafter (Table 3-24).

1983 and 2000

Table 3-22 Breakdown of Discharged Traffic into Imports and Inbound Domestic Trade

Commodity group	1983				2000			
	Incoming traffic (1) (1,000 tons)	Imports (2) (1,000 tons)	Inbound domestic trade (3) (1,000 tons)	(2)/(1) (%)	Incoming traffic (1) (1,000 tons)	Imports (2) (1,000 tons)	Inbound domestic trade (3) (1,000 tons)	(2)/(1) (%)
Food	140	28	112	20	249	50	199	20
Production material	92	8	84	9	702	100	602	
(Fertilizers)	(76)	(-)	(76)	(-)	(366)	(-)	(366)	(-)
(Machine & other production materials)	(16)	(8)	(8)	(50)	(336)	(100)	(236)	(30)
Construction materials	180	21	159	12	376	56	320	15
(Steel)	(42)	(21)	(21)	(50)	(185)	(56)	(129)	(30)
(Cement)	(79)	(-)	(79)	(-)	(-)	(-)	(-)	(-)
(Asphalt)	(20)	(-)	(20)	(-)	(89)	(-)	(89)	(-)
(Housing materials)	(25)	(-)	(25)	(-)	(82)	(-)	(82)	(-)
(Others)	(14)	(-)	(14)	(-)	(20)	(-)	(20)	(-)
Miscellaneous	128	13	115	10	613	34	579	6
Total excluding oil	540	70	470	13	1,940	240	1,700	12
Oil	290	0	290	0	1,500	0	1,500	0
Total	830	70	760	-	3,440	240	3,200	-

Table 3-23 **Classification of Traffic by Type of Commodity and by Berthing Facility**

Facilities and commodities	1975 (1,000 tons)	1983 (1,000 tons)	2000 (1,000 tons)
Quay	444	750	3,740
General Cargo	444	650	2,332
Dry Bulk	-	100	1,113
Liquid Bulk	-	-	295
Buoy and anchorage	606	1,770	2,300
Dry Bulk	606	1,770	2,300
Petroleum Jetty	136	290	1,500
Liquid Bulk	136	290	1,500
Total	1,186	2,810	7,540

Table 3-24 **Passenger Embarkation and Debarkation at Banjarmasin Port**

Year	Embarkation	Debarkation	Total Passenger Traffic
1968	3,211	2,146	5,357
1969	2,458	4,141	6,599
1970	11,576	8,461	20,037
1971	11,001	10,543	21,544
1972	11,381	9,077	21,288
1973	13,179	12,160	25,339
1974	11,948	8,518	20,466
1975	6,118	4,710	10,828

It is considered that the number of outgoing and incoming passengers in the future shall increase in relation to the increase of the population, the brisk activity of the economy and the increase of income in the service area.

It is forecasted that the incoming and outgoing passengers at the Port of Banjarmasin in 1983 and in 2000, shall increase in proportion to the rate of population growth, resulting in 35,000 persons and 56,000 persons, respectively.

3-6. Outlook for Calling Vessels

3-6-1. General

The future outlook for calling vessels is as important as the forecast of port tonnage traffic in planning the target of a port in future. This outlook relates particularly to the determination of the water depth in a navigation channel and basin and of the length of mooring facilities, in the Banjarmasin Port planning.

Calling vessels are first of all affected by the kinds and quantities of the cargoes handled in the port. However, there are elements which are determined independently of the cargoes handled in the port. For example, the shipping policy of the country is a large element to regulate the calling vessels of respective ports, and with regard to ocean going vessels, the wills of shipping conferences are decisively important for the calling vessels of liner ports. On the contrary, port conditions often affect shipping conditions. After all, it can be said that port conditions and shipping conditions are relatively settled through mutual influence.

The main purpose of this section is to consider the maximum draft of calling vessels as an important element for planning basic facilities. Below will be analyzed the present conditions, and then with other elements taken into consideration, the future outlook will be formed.

3-6-2. Kind and Quantities of Calling Vessels

1975:

Table 3-25 shows statistics regarding the vessels which called at Banjarmasin Port in 1975. Table 3-25 gives the numbers of calling vessels classified into entering vessels and outgoing vessels, together with total DWTs, by kinds of ships. since there is no large difference between entering vessels and outgoing vessels both in total number ans ship kinds composition, outgoing vessels only will be described below.

Total of 5,221 vessels departed from Banjarmasin Port in 1975. Of them, there were 80 general cargo vessels (1.5%) and 172 logs carriers (3.3%), both together being 252 vessels (4.8%) as ocean going vessels. Domestic trade vessels accounted for the ramining 95.2%. Main kinds in the domestic trade vessels were sailing vessels (48.5%) and motor vessels (23.6%). In addition, there were RLS vessels, non RLS vessels, local boats and oil tankers.

Table 3-25 Calling Vessels at Port of Banjarmasin in 1975

Kind of Ships	Outgoing				Entering			
	Vessels		1,000 DWT		Vessels		1,000 DWT	
Ocean going vessels								
a. General	80	(1.5)	95	(4.5)	81	(1.5)	98	(4.7)
b. Timber	172	(3.3)	1,009	(47.7)	162	(3.0)	960	(46.4)
RLS Vessels	311	(6.0)	177	(8.4)	307	(5.8)	161	(7.8)
Non RLS vessels	71	(1.4)	58	(2.7)	73	(1.3)	59	(2.9)
Local vessels	624	(11.9)	158	(7.4)	625	(11.7)	161	(7.7)
Sailing vessels	2,533	(48.5)	452	(21.4)	2,669	(50.2)	467	(22.5)
Motor vessels	1,232	(23.6)	86	(4.1)	1,206	(22.7)	85	(4.1)
Oil tankers	131	(2.5)	66	(3.1)	131	(2.5)	66	(3.2)
Others	67	(1.3)	15	(0.7)	67	(1.3)	15	(0.7)
Total	5,221	(100.0)	2,116	(100.0)	5,321	(100.0)	2,072	(100.0)

Notes: 1) Source: ADPEL
2) ( ) shows percentage composition to total.

The total deadweight tonnage of calling vessels was 2,116,000 tons. Of it, ocean going vessels accounted for total 53.2% with general cargo vessels (4.5%) and logs carriers (47.7%) put together. Unlike the share (4.8%) by the number of vessels, a large share was taken among all the calling vessels in the case of total deadweight tonnage. Of domestic travel vessels, the largest share by total deadweight tonnage was taken by sailing vessels (22.5%), and the figure is smaller than that by the number of vessels. Motor vessels accounted for 4.1% in leading capacity, being less important than the share (23.6%) by the number of vessels. The shares by total deadweight tonnage of other domestic travel vessels (RLS vessels, non RLS vessels, local boats and tankers) are almost same as those by the number of vessels.

1983 and 2000:

The vessels which will call at Banjarmasin Port in future will be ocean going liners, ocean going tramp vessels, and various kinds of domestic travel vessels. The kinds of calling vessels are surmised to remain same as those of present. It is not necessary for the time being to consider in planning that LASHs, container ships, seatrains, etc. will call at Banjarmasin Port. Banjarmasin Port is relatively of small-scale among Indonesian ports, and even if new transportation system should be introduced into Indonesia, its application to Banjarmasin Port is surmised to occur considerably in future years.

With regard to ocean going liners, what lines to assume is the first problem. The liners calling at Banjarmasin Port are considered a part of the liners calling at various ports around Java Sea, and those of Sulawesi and Kalimantan. The cargoes transported for the time being by the liners on these lines must mostly be imported to Java Island. Liners from foreign countries will discharge imports first at Tg Priok or Surabaya Port. In these ports, relatively expensive exports warranting high ocean freights will be loaded. At ports with relatively small ship cargo load, for example at Banjarmasin Port, liners will call after the drafts become shallow. At Banjarmasin Port, small lots of exports and imports excluding large lots of timber and ores are surmised to be loaded and discharged periodically.

Tramp vessels will be used for exporting timber as done at present. In the year of 2000 A.D., 800,000 tons of ores are forecast to be exported, and they will be loaded in tramp vessels judging from the lots.

Domestic travel vessels are qualitatively greatly different in marine transportation among the respective kinds, and cannot be dealt with on the same level without any problem, but since their scale is smaller than that of ocean going vessels, they affect the port physical planning less than ocean going vessels. However, tankers are special in application among domestic travel vessels, and must be considered separately.

Among passenger ships, pilgrimage boats for Mecca are ocean going passenger ships, and will be relatively large. However, in light of demand at Banjarmasin Port, it is hard to imagine that they will call at Banjarmasin Port in full load, and in the planning, it will be sufficient to consider that they will call with the drafts suitable for the depth of channel.

The number of vessels calling at Banjarmasin Port in future is calculated according to the following equation.

$$\text{Number of calling vessels} = \frac{\text{Port tonnage traffic}}{\text{Ship cargo load handled per ship call}}$$

If the vessels are classified into ocean going liners, ocean going tramp vessels, domestic travel general cargo vessels and tankers, and the numbers of calling times are calculated for the respective vessel kinds for 1983 and 2000 by using the above equation, the results are as shown in Tables 3-26 and 3-27. The ship cargo loads handled per ship call used for these calculations are in accordance with paragraph 3-6-3 described below.

3-6-3. Ship Cargo Load Handled per Ship Call

Till 1975:

The ship cargo load handled per ship call of the vessels calling at Banjarmasin Port in 1975 was 226 tons/vessels. Of the load, three fourths were cargoes loaded and one fourth was cargoes discharged, as a whole, loaded cargo load being larger than discharged cargo load (Table 3-28).

By kinds of ships, the ship cargo load handled per ship call of ocean going timber vessels was 3,523 tons/vessel, excelling those of others. It was followed by that of domestic travel tankers, 1,041 tons/vessel. Then, it became smaller in the order of ocean going general vessels, domestic travel non RLS vessels, and RLS vessels. The cargo load handled by local vessels was almost same as that of sailing vessels. The ship cargo load handled per ship call of motor vessels was considerably small compared to those of other kinds of ships.

In light of tendency with the lapse of time, it cannot be said that the ship cargo loads handled per ship call tended to increase smoothly or tended to decrease. There were yearly fluctuations only. The ship cargo loads handled per ship call were almost large in 1973 and 1974 only.

1983:

As far as the statistics of Banjarmasin Port indicate, there is no clear tendency that the ship cargo loads handled per ship call have kept increasing or decreasing in these 5 years. The ship cargo loads per ship call in 1983 were calculated by rounding the maximum values in the past 5 years (Table 3-26).

2000:

(1) Liners:

Table 3-26 Forecast of Ship Calls in 1983 at Port of Banjarmasin

Kind of Ships	Cargo Load Loaded 1,000 tons	Cargo Load Discharged 1,000 tons	Cargo Load Total 1,000 tons	Cargo Load per Ship Call tons/call	Ship Calls per Year calls/year
Ocean going vessels					
Liner	120	70	190	800	240
Tramp vessels	1,360	–	1,360	5,000	270
(Timber)	(1,360)	–	(1,360)	(5,000)	(270)
Domestic trade vessels					
General	500	470	970	120	8,080
Oil tankers	–	290	290	1,200	240
Total		–		–	8,830

Table 3-27 Forecast of Ship Calls in 2,000 at Port of Banjarmasin

Kind of Ships	Cargo load Loaded	Cargo load Discharged	Cargo load Total	Cargo load per ship call	Ship calls per year
	1,000 tons	1,000 tons	1,000 tons		
Ocean going vessels					
Liners	800	240	1,040	1,500	690
Tramp vessels	1,500	–	1,500		190
(timber)	(700)		(700)	(8,000)	(90)
(Ore)	(800)		(800)	(8,000)	(100)
Domestic trade vessels					
General	1,800	1,700	3,500	250	11,670
Oil tankers	–	1,500	1,500	2,000	750
Total		–		–	13,300

Table 3-28 Average Ship Cargo Load Handled per Ship Call at Port of Banjarmasin

tons per ship

Kind of ships	1971			1972			1973			1974			1975		
	Loaded	Discharged	Total	Loaded	Discharged	Total	Loaded	Discharged	Total	Loaded	Discharged	Total	Loaded	Discharged	Total
Ocean going vessels															
a. General	501	235	736	295	130	425	297	113	410	508	168	676	373	185	558
b. Timber	3,157	–	3,157	3,483	–	3,483	5,011	–	5,011	4,793	–	4,793	3,523	–	3,523
RLS vessels	53	168	221	54	56	110	43	57	100	123	209	332	111	133	244
Non RLS vessels	27	99	126	101	268	369	134	256	390	85	124	209	175	167	342
Local vessels	28	3	31	15	2	17	14	2	16	67	106	173	57	41	98
Sailing vessels	44	30	74	54	28	82	46	21	67	63	34	97	48	27	75
Motor vessels										12	1	13	14	1	15
Oil tankers	–	532	532	–	289	289	–	258	258	–	951	951	–	1,041	1,041
Others													359	2	361
Average	151	72	223	179	71	250	179	52	231	204	69	273	169	57	226
Average of domestic trade vessels excluding oil tankers	41	45	86	53	59	112	45	39	84	53	47	100	51	31	82

Note: 1) Derived from the data of ADPEL

Liners sail according to the schedules prepared by shipping companies based on their decision for business. Therefore, ship calls change according to the demand. Table 3-29 shows the ship cargo loads handled per liner call at Port of Surabaya. It shows that the ship cargo loads handled per liner call in the past 4 years were 2,000 to 2,500 tons/call. Table 3-30 shows liner cargo loads at Port of Surabaya. Table 3-29 being compared with Table 3-30, the ship cargo loads per ship call were 1,100 to 1,600 tons/call for one million tons of liner cargo load. As a round number, 1,500 tons/call is taken for Banjarmasin Port in 2000.

(2) Tramp vessels:

Tramp vessels transport exports in full load in most cases. When cargo lots are small or water depth is shallow, cargoes may be loaded at 2 ports or more. As described in 6-3-4 Ship Size Forecast, as regards the maximum size of tramp vessels, there are 10,000 DWT vessels calling as logs carriers and ore vessels. Considering that vessels with the size of 80% volume are used to transport exports in full load on the average, the ship cargo load per ship call is assumed to be 8,000 tons/call.

(3) Domestic travel general cargo vessels:

The Pelita II aims at increasing the cargo load handled of domestic travel vessels as a policy. As the organized vessels such as RLS vessels and non RLS vessels increase in share, the ship cargo load handled per ship call is surmised to increase naturally, but quantitative outlook is difficult to be formed. As described in 3-6-4 Ship Size Forecast, domestic travel vessels are surmised to become larger in the long run, and therefore the ship cargo load handled in 2000 is assumed to be about double, viz. 250 tons/call.

(4) Tankers:

The cargo load hanled of tankers reached 1,041 tons/call already in 1975. It is assumed to be approximately doubled in 2000, to be 2,000 tons/call.

3-6-4. Ship Size

Till 1975:

Table 3-31 shows the average sizes of vessels calling at Banjarmasin Port by kinds of ships. According to it, in the port, logs carriers provide the largest size and then the size becomes smaller in the order of general ocean going vessels, non RLS vessels, and tankers. Sailing vessels are far smaller. In light of tendency in these 5 years, logs carriers remained to occupy the top place in ship size. In 1974, logs carriers reached 6,851 DWT on the average, marking the highest record in these 5 years. As regards logs carriers, there is no tendency observed for particular increase in ship size. As for other kinds of ships, only non RLS vessels showed increase in ship size, and yet whether this tendecny of non RLS vessels has settled

Table 3-29 Average Liner Ship Cargo Load Handled per Ship Call (Port of Surabaya)

tons/call

Year	1971	1972	1973	1974
Loaded	1,104	1,083	894	906
Discharged	940	1,327	1,624	1,593
Total	2,044	2,410	2,518	2,499

Note: Derived from Port of Surbaya Statistical Report

Table 3-30 Liner Ship Cargo Load at Port of Surabaya

1,000 tons

Year	1971	1972	1973	1974
Loaded	769	668	654	797
Discharged	654	819	1,187	1,402
Total	1,423	1,487	1,841	2,199

Note: Derived from Port of Surabaya Statistical Report or not is not clear, since they just increased suddenly to 3 times in ship size in 1975.

Table 3-32 shows the sizes of vessels calling at Banjarmasin Port by tonnage. Seeing the average ship size of large vessels of 5,300 DWT (= 10,000 m^3) or more only, there are fluctuations only, showing no tendency for increase in ship size.

1983:

(1) Liners:

Table 3-33 shows the average sizes of Indonesian ocean going vessels by tonnage in the past 4 years. The average ship sizes did not exceed 10,000 DWT during this period. Table 3-34 shows the average ship sizes of liners calling at Port of Surabaya, and they did not exceed 8,000 DWT. Therefore, assuming 10,000 DWT as size of liners in 1983 is sufficient.

(2) Tramp vessels:

The tramps vessels calling at Banjarmasin Port in 1983 are assumed to be logs carriers only. As logs carriers to Indonesia, larger vessels than those calling at Banjarmasin Port are now calling at other ports, subject to port conditions. Judging from the amount of timber expected to be exported from Banjarmasin Port in 1983, sudden increase in ship size is not surmised to occur generally. It will be proper to assume 8,000 DWT class vessels for 1983 which are now increasing as timber vessels to Indonesia.

(3) Domestic travel general cargo vessels:

As far as the results of domestic travel vessels calling at Banjarmasin Port are concerned, there is no tendency of increase in ship size. Table 3-35 shows the sizes of domestic travel vessels ordered by Indonesia recently. According to it, domestic travel vessels exceeding 2,000 DWT are not surmised to be main vessels in Indonesia for the time being.Therefore, the size of domestic travel vessels calling at Banjarmasin is assumed to be 2,000 DWT at the largest.

(4) Tankers:

As in the case of general domestic travel vessels, the ship size in 1983 of tankers is assumed to be 2,000 DWT.

2000:

In 2000, it can be presumed that the economic activities in Indonesia will be brisk, to increase cargo loads in ports and harbors, and that accordingly, the port improvement will progress. The progress of port improvement and the increase in ship size are promoted in most cases with their correlation maintained. Therefore, it will be practical to assume that the ship size in 2000 is one rank higher than that in

Table 3-31 Average Ship Size by Type of Ship at Port of Banjamasin

DWT

Type of Ships	1971	1972	1973	1974	1975
Ocean going vessels					
a. General	1,568	1,560	755	1,206	1,190
b. Timber	5,198	5,588	6,422	6,851	5,865
RLS Vessels	312	551	323	571	566
Non RLS Vessels	223	273	245	273	816
Local vessels	47	56	77	214	253
Sailing vessels	148	129	173	136	178
Motor vessels				76	70
Oil tankers	1,274	1,116	787	565	505
Others	–	–	–	–	231
Total	412	435	444	386	405

Note: Figures are those of outgoing vessels

Table 3-32 Average Ship Size by Its Class at Port of Banjarmasin

DWT

Ship size	1971	1972	1973	1974	1975
< 800 DWT	275	248	287	301	309
800 – 5,300 DWT	3,022	2,919	2,234	2,238	2,480
> 5,300 DWT	6,858	7,113	?	7,249	6,411

Notes: 1) Calculated from the figures by converting the GRT expressed in m^3 in the data of ADPEL into DWT by simply multiplying 0.353 x 1.5.
2) Data excluding tankers

Table 3-33 Average Ship Size by Its Class of Indonesian Ocean Going Vessels

DWT	1971	1972	1973	1974
< 1,000			–	–
1,001 – 2,000			–	1,341
2,001 – 5,000			4,181	3,180
5,001 – 10,000			7,320	7,268
> 10,000			11,358	11,468
Total	9,253	8,811	8,614	8,573

Note: Derived from Statistik Indonesia

Table 3-34 Average Ship Size of Liners Calling to Port of Surabaya

DWT

Year	1971	1972	1973	1974
Ship size	7,326	7,932	7,914	7,715

Note: Derived from Ports of Suraboya Statistical Report

Table 3-35 Domestic Travel Vessels under Construction

Kind of vessel	DWT	Number of vessels	Construction yards
Cargo-passenger ship	750	6	Local yards
	950	3	"
Cargo-passenger ship	950	5	Norwegian yards
Pure cargo vessel	980	5	"
Cargo-passenger vessel	1,650	5	"
Pure cargo vessel	1,700	5	"
Total		29	

Source: Far Eastern Economic Review

1983. The size of liners is assumed to be 15,000 DWT which is leading in the world at present, and the size of tramp vessels is assumed to be 10,000 DWT which is one rank larger than 8,000 DWT assumed for 1983. The size of domestic travel general cargo vessels and tankers is assumed to be 3,000 DWT which is one rank larger than the size for 1983.

Chapter-4

Siltation at the Access Channel

CHAPTER 4

SILTATION AT THE ACCESS CHANNEL

4-1. Introduction

Maintenance of the access channel completed at the river mouth of Barito is a prerequisite for promotion of the Central and South Kalimantan development scheme. Yet, it is difficult to see, from the condition of siltation at the access channel soon after completion, whether it is difficult or not to maintain the access channel properly. Normally, the condition of siltation after completion differs greatly from that occurring during the construction work, and any attempt to estimate the siltation amount or clarify the mechanism of siltation with the technical data obtained during the construction work alone will not always be successful.

For estimation of the siltation, data of observation with respect to the conditions of siltation, waves, current, salinity, suspended materials, etc. during the construction period and after the completion are very useful.

However, the meteorological and hydraulic conditions vary more or less from year to year so that it is risky to estimate the future amount of siltation with the observations during the construction period and a very short period after the completion and plan the dredging work for maintenance upon such estimation alone.

Sounding of the depth in the access channel and its surrounding areas, hydraulic and soil surveys are indispensable for effective and economic utilization of the access channel and planning of the maintenance dredging work, and they should be carried out successively over a considerable period hereafter.

In this Chapter, the data on conditions that may affect the siltation at the access channel in the estuary of the Barito River which assumes an important position in the development of the Banjarmasin Port are accumulated and arranged. Then, the mechanism of siltation at the access channel is clarified and the annual amount of siltation is estimated upon the results of observation and some assumptions.

4-2. Natural Conditions

4-2-1. Topography of Barito River-basin

The Barito River the catchment area of which is said to be 74,600 km^2 rises in the mountain at the northern boundary. It incises gorges at the upper stream, curves at the middle stream, leaving small crescent lakes here and there, and meanders through the low land and flows into the Java Sea. It stretches about 650 km the greater part of which flows through the low land of an altitude less than 100 m. Now, taking the altitudes of Puruktjau and Muarateweh about 350 Km upstream from the river mouth, for example, they are 52.5 and 37.5 m respectively, while Kualasirau located at the upstream end of the low land about 200 Km from the river mouth has an altitude of only about 15 m. Thus, the Barito River may be said to be a nearly horizontal river over a very long distance.

The low land extending between Marabahan about 80 Km upstream from the river mouth and Tandjung Burung at the river mouth of the Barito River is of a height of about 2 m above sea and is submerged over a wide range in the rainy season.

The tidal compartment of the Barito River ranges up to about 150 Km from the river mouth, and the tidal ranges along the river are as shown in the following:

Barito river mouth	2.9 m
Banjarmasin (about 30 km from the river mouth)	2.5 m
Marabahan (about 80 km from the river mouth)	1.5 m
Pamingir (about 130 km from the river mouth)	0.9 m

The Barito River has no bank on each side. Thus, in the rainy season, the river water floods over the low land, thus providing natural control of the discharge of the Barito River. Seashore close to the river mouth takes the form of a sandy mud beach created by waves.

4-2-2. Geology of Barito River-basin

Fig. 4-1 is a geological map of this area.

The quaternary layer constitutes a greater part of the river-basin. Towards the east, there exist the mesozoic mountains extending from SSW to NNE, and the tertiary hilly land where Alangalang is growing.

4-2-3. Meteorological Condition

(1) Wind

Winds occurring at the river mouth of Barito are illustrated in Table 4-1 and Fig. 4-2.

The Barito River-basin belongs to the tropical region so that the cyclone is seldom generated. But, gusts often take place due to ascending currents occurring locally.

(2) Precipitation

The annual precipitation is 3,500mm in the mountainous area, 3,000mm in the eastern area or 2,500mm in the low land (refer to Fig. 4-3).

Seasonally, the year is divided into a dry season and a rainy season according to the rainfall, but the duration of the respective seasons is somewhat different from year to year. In this area, the dry season occurs normally in the period of from May

Table 4-1: Occurrence of Wind

Period	Normal Wind		Storm Wind			Season
	predominant direction	occurrence of wind faster than 20 mph	predominant direction	meteorological condition	location	
Dec. – Feb.	W, NW	17% (Jan.)	W	tropical cyclone, squall		north west monsoon
Mar. – May	E, SE	8%		tropical cyclone	southern sea of Java	
Jun. – Sep.	E, SE	21% (Aug.)	SE, S	tropical cyclone	north hemisphere	south east monsoon
			E, SE	high pressure, squall	travelling eastward on Java Sea	
Oct. – Nov.	all directions	1%		tropical cyclone	south hemisphere (Nov.), South China Sea, southern Phillipines	

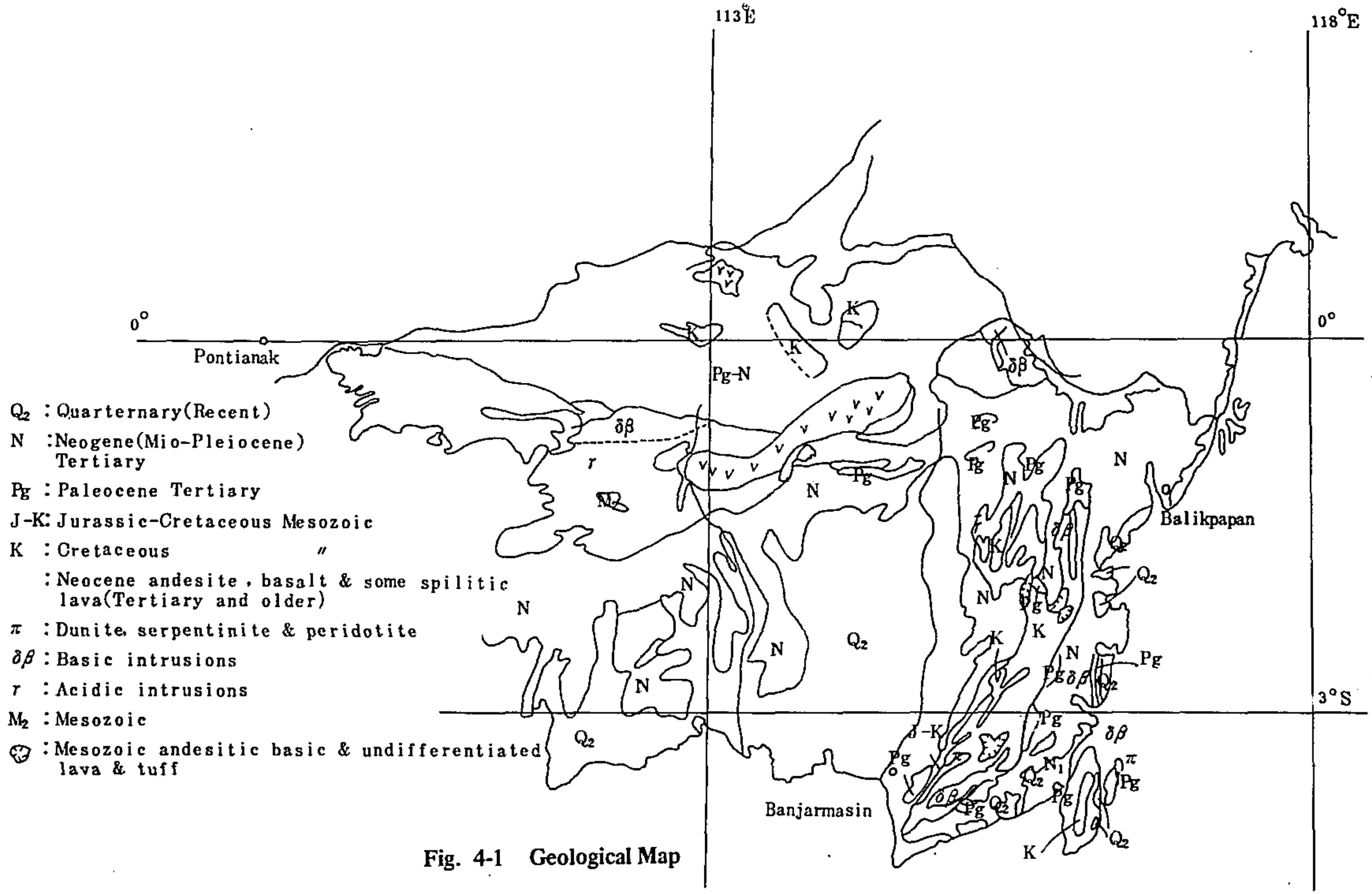


Fig. 4-1 Geological Map

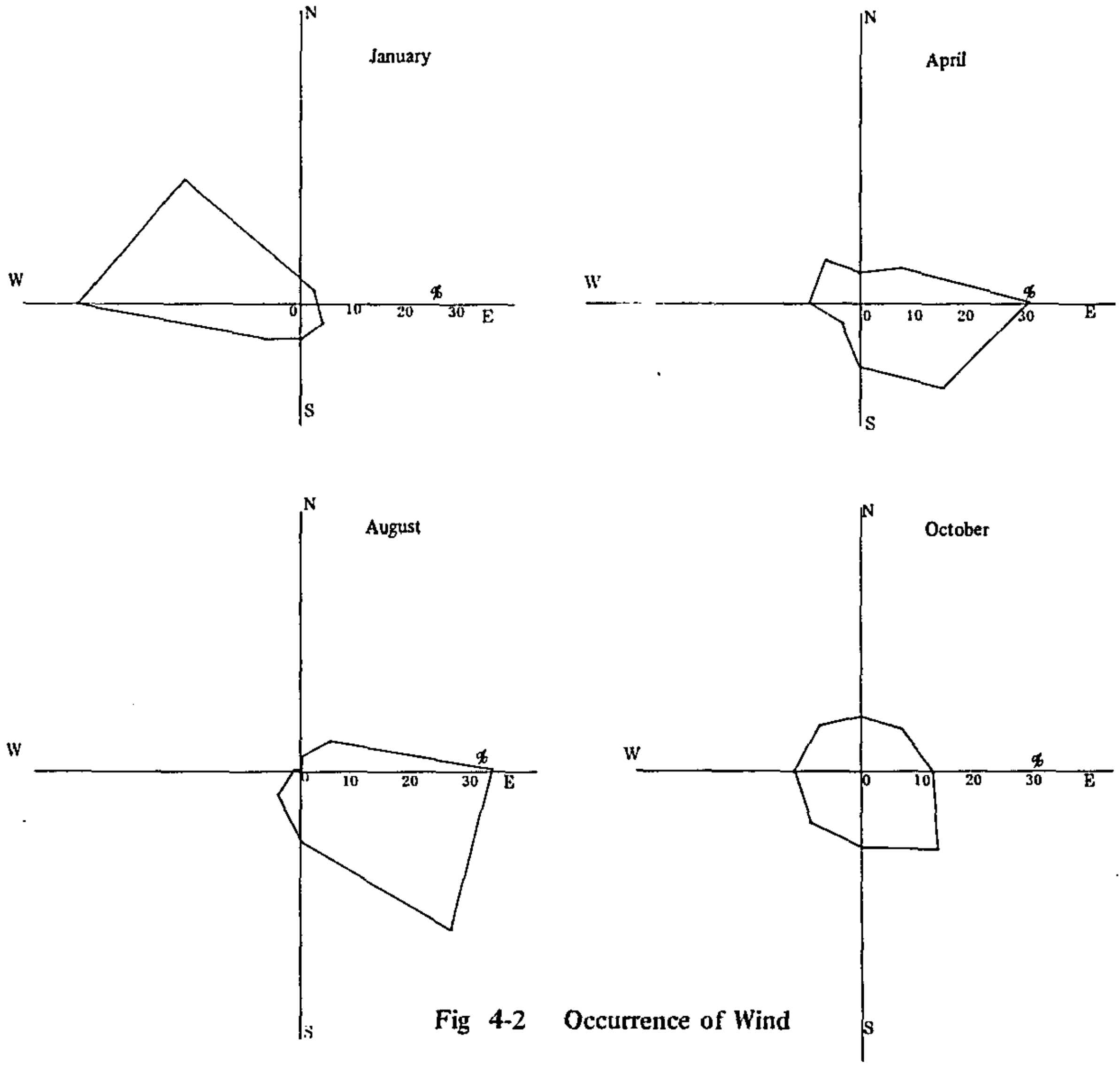


Fig 4-2 Occurrence of Wind

to October with little rainfall observed, while the rainy season occurs from November to April with more than two-thirds of the annual rainfall observed (refer to Fig. 4-4).

4-2-4. Hydraulic conditions

(1) Wave

The results of observation at the location of 5°S, 115°E and a water depth of 27m are shown in Table 4-2.

Table 4-2: Occurrence of Wave

Period	Wave Height > 1.8 m		Season
	direction	occurrence	
Dec. – Feb.	W, NW	15% (Jan.)	north west monsoon
Mar. – May	E, SE	8% (Apr.)	
Jun. – Sep.	E, SE	21% (Aug.)	south east monsoon
Oct. – Nov.	all directions	1%	calmest season

Observation of the waves was conducted in the shallow water area of the Barito river mouth during the period of the dredging work of the access channel from August 1975 to August 1976. The monthly mean values of the maximum wave height range from 0.3m to 0.5m as shown in Table 4-3. Generally, the wave becomes higher in the afternoon, because of a sea-to-land breeze.

Table 4-3: Monthly Maximum Wave Height (During Works)

Month	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.
Average maximum wave height (m)	0.87	0.40	0.32	0.28	0.45	0.41	0.25	0.35	0.30	0.57	0.70	0.77	0.38
Water depth around the access channel (m)	5.7	3.4	4.2	2.3	1.9	1.7	1.4	1.3	1.3	1.4	6.0	1.3	4.2

High waves were noted during the south-eastern and north-western monsoon seasons, but the point of observation was not the same but moving along the access channel. Thus, it will not be appropriate to use these values of observation directly in the analysis.

(2) Current

In the completed access channel extending out of the Barito river mouth into the sea, it is observed that the ebb tide continues for about 18 hours a day with a maximum current velocity over 1.5 m/sec. With regard to the flood tide, its duration

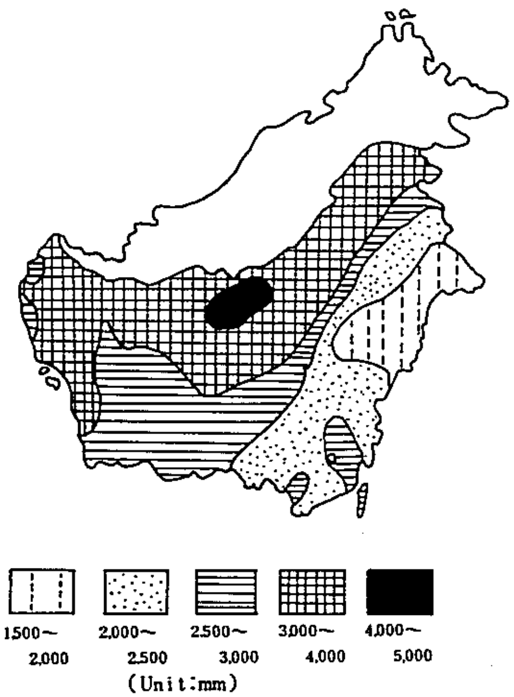


Fig 4-3 Annual Rainfall

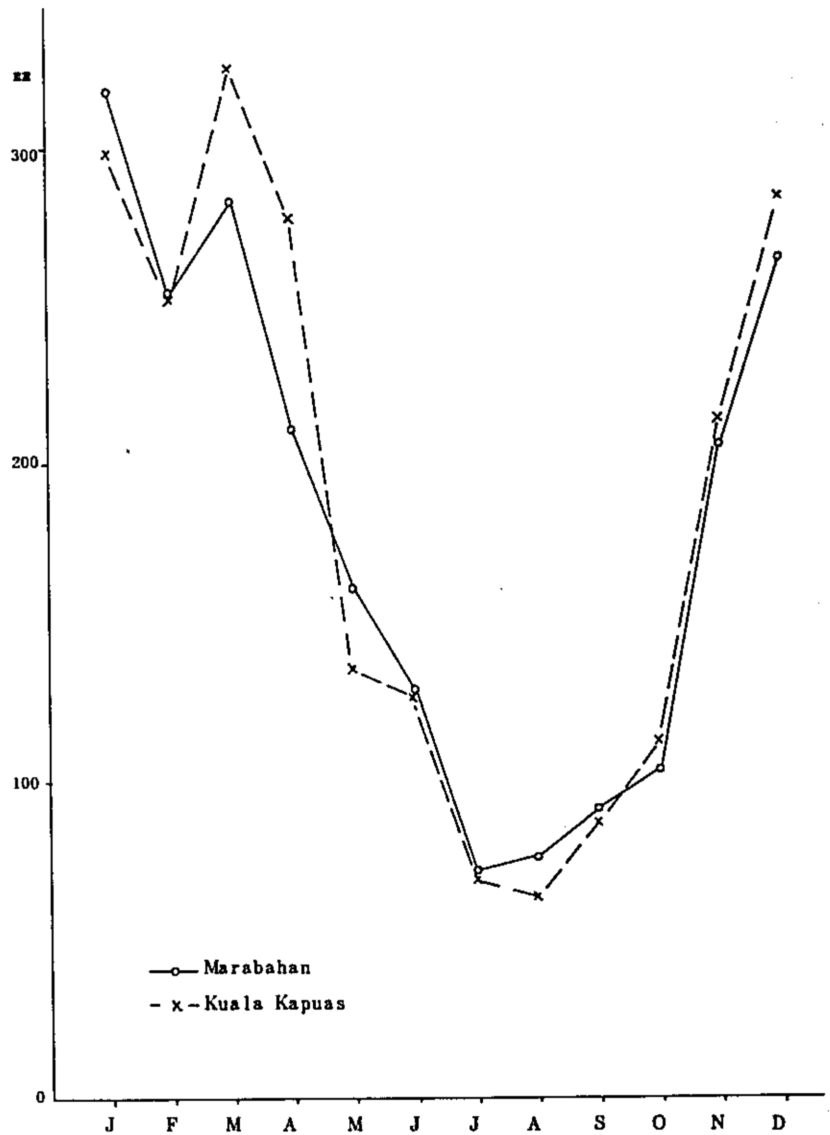


Fig 4-4 Monthly Rainfall
(averaged between 1917 and 1941)

and velocity are less than those of ebb tide. In the area of Trisakti where the Banjarmasin Port is located, a salt wedge is normally present at the bottom in the dry season, but in the rainy season, it penetrates only for a few hours of high tide.

Off the river mouth, the river water of Barito flows out radially in a thin layer at the surface.

In the half part of the access channel closer to the land, the water is subject to the influence of the tide and goes and returns along the access channel.

At the center of the access channel, the maximum velocity is reduced to about one half of that observed at either side of the channel near the land.

In the offing half of the access channel, the flow is governed by the general tidal current in the shallow water area, so that it is directed toward north-west at the flood tide or south-west at the edd tide.

As the river flow exceeds the critical velocity specified below, the salt wedge is eliminated gradually.

$$C = \sqrt{\epsilon g H}$$

where $\epsilon = (\rho_s - \rho) / \rho_s$ (ρ_s : Density of salt water; ρ : Density of fresh water)

g : Gravitational acceleration
H : Water depth.

For example, the critical velocity against a water depth of 12 m is given as follows;

$$Vc = 1.5 \text{ m/sec.}$$

(3) Tide

In the Java Sea, the diurnal tide is predominant. The sea levels at the river mouth of Barito are as follows;

+2.96 m	Indian spring high water
+1.60 m	Mean sea level
+0.24 m	Indian spring low water
±0.00 m	Datum level

The monthly mean water level is highest in February and lowest in August, the difference being about 0.2 m.

(4) Salinity

The concentration of salt in sea water is expressed normally in terms of the specific gravity of sea water at a standard temperature of 15°c.

Through the survey at the site, there was obtained the result shown in Fig. 4-5 with respect to the distribution of the salinity in the access channel.

The salinity in the Java Sea is reported to be 32 to 33 percent, but at the river mouth of Barito, it is affected by the river water and is reduced to 23.6 percent.

At the upper side end of the access channel, mixture of the salt water was in a ratio of about 1/8 of the total flow during the ebb tide, and at the center and the lower side end during the ebb tide, it was about 1/2 and 9/10 respectively. In other words, the salt wedge at the bottom of the access channel is present over the whole length of the access channel at all times.

It is seen that the flushing in the dry season is due not to the river water but to the sea water current.

4-3. Siltation Analyses

4-3-1. Previous Studies

The discharge of the Barito River is estimated as 123 x 10^9 m^3/year in the annual discharge or 2,800 m^3/sec by the following formula.

	Annual rainfall		Catchment area		Runoff ratio		Annual discharge		
	2.712 m	x	75.6 x 10^9 m^2	x	0.6	=	123 x 10^9 m^3/year		
or									
	3 m	x	60.0 x 10^9 m^2	x	0.5	=	90 x 10^9 "	=	2,800m^3/sec.

On the presumption of the above runoff ratio, the ratio of the evapotranspiration becomes 40 to 50 percent.

The Indonesian Navy reported an estimated of the amount of transported material of the Barito River at bout 250 million m^3/year, based on the mean concentration of suspended material estimated to be 3,500 g/m^3.

According to the survey conducted at the site lately, the maximum concentration in the downstream of the Barito River was about 100 g/m^3 in the ebb tide.

In 1974, on the occasion of the survey, Dr. Tsuruta, Director of the Port and Harbor Research Institute of the Ministry of Transport, pointed out that if a access channel was to be provided at the river mouth of Barito, siltation would be an unavoidable problem and thus emphasized importance of the maintenance dredging.

At that time, there was no data available on the siltation, and it was reported that

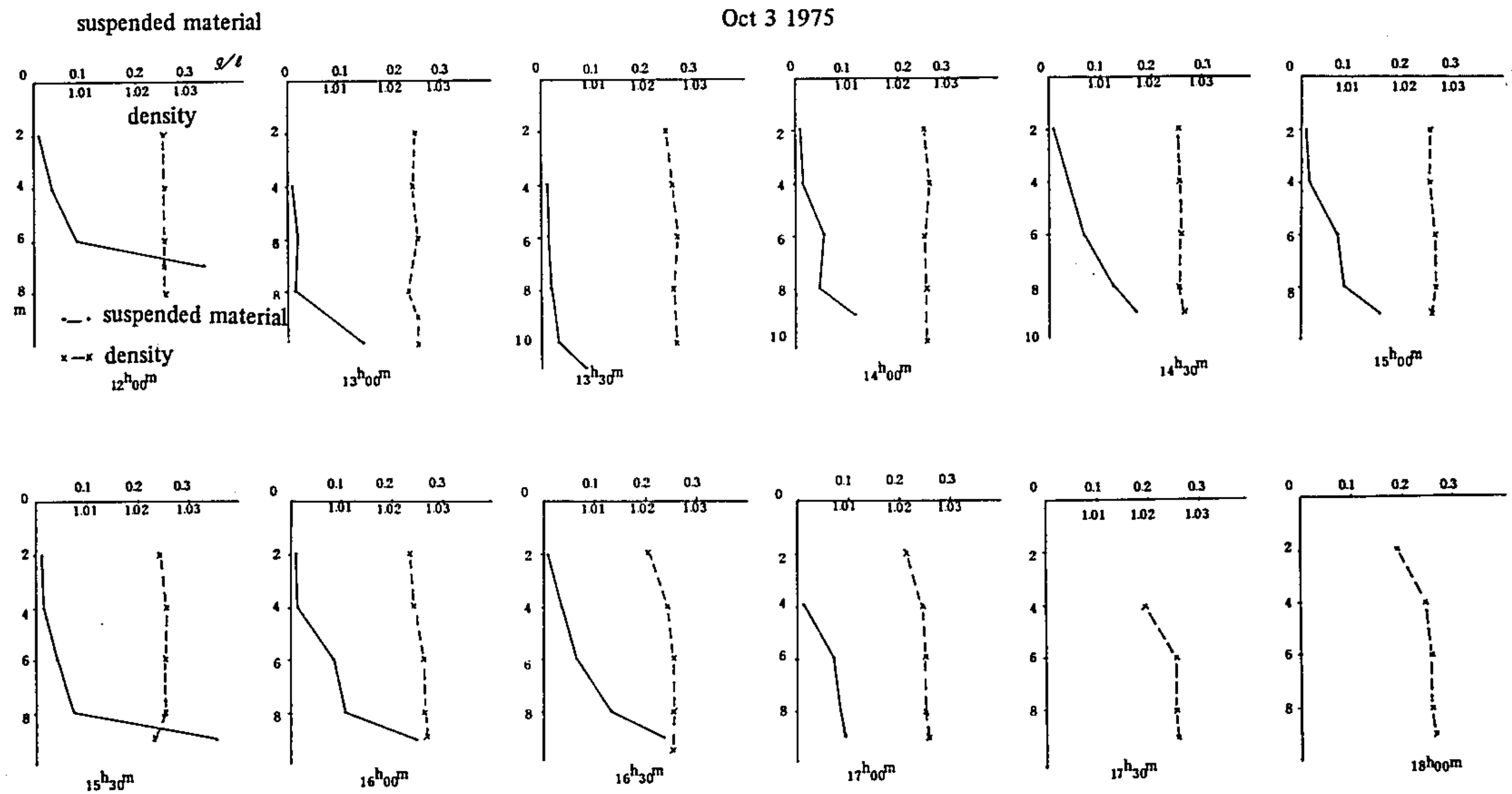


Fig. 4-5 Suspended Material and Water Density at Buoy 1
(Offshore end of channel)

the siltation would not be less than 500,000 m^3/year, although the estimate had to be made from the conditions of siltation in the river mouth ports in Japan.

4-3-2. Siltation in Geological Age

Referring to fig. 4-6, the Barito River extends a valley into the shallow water area.

In the latest glacial age, i.e. 10 to 20 thousand years ago, the sea level was 100 to 200 meters lower than that of the present time because of the eustatic change, the present continental shelf constituting the seashore at that time.

The drowned valley seen in the water in front of the Barito River was apparently on land then, and the rivers including the Barito have apparently been kept fixed approximately at the present locations throughout the geological period.

Fig. 4-6 shows enormous amount of siltation in the shallow sea basin of a depth less than 9 m.

The Java Sea has the maximum depth of about 70 m. It would then be natural to assume that this enormous amount of siltation started after submergence of the Java Sea.

The time of submergence in this area is not obvious, but it may be presumed to be about the 2/3 period of the Holocene or about 7,000 years ago.

Assuming that the water area in a triangle ABC in Fig. 4-6 had a deposition in a thickness of 7 m, the annual siltation will now be calculated. The triangular column has a volume of 2.5×10^9 m^3. By dividing this by the number of years, i.e. 7,000 (years), the annual siltation is estimated at 350,000 m^3.

4-3-3. Siltation in the Access Channel

Dredging of the access channel at the Barito river mouth was started at the river mouth end in August 1975 and came to the planned offing end in June 1976 (refer to Fig. 4-7). Subsequently, cleaning dredging was carried out, and the work was completed over the whole extension of the access channel in early September. A 8,000 horse power pump dredger was used, and the amount of dredged soil in the respective months was nearly constant at about 700,000 m^3.

The amount of siltation in the access channel is obtainable by measuring the water depth at a regular interval (every one to three months) and comparing the sounding charts plotted by such measurements with one another. The siltation during the work period varied with the location in the access channel or the season, but was affected most greatly by the depth of the access channel (refer to Table 4-4). The total amount of siltation during the work period from August 1975 to June 1976 was calculated as 4,680,000 m^3. The month of July is in the dry season and seems to be of small siltation. Thus, the foregoing value may be taken approximately as an annual amount of siltation.

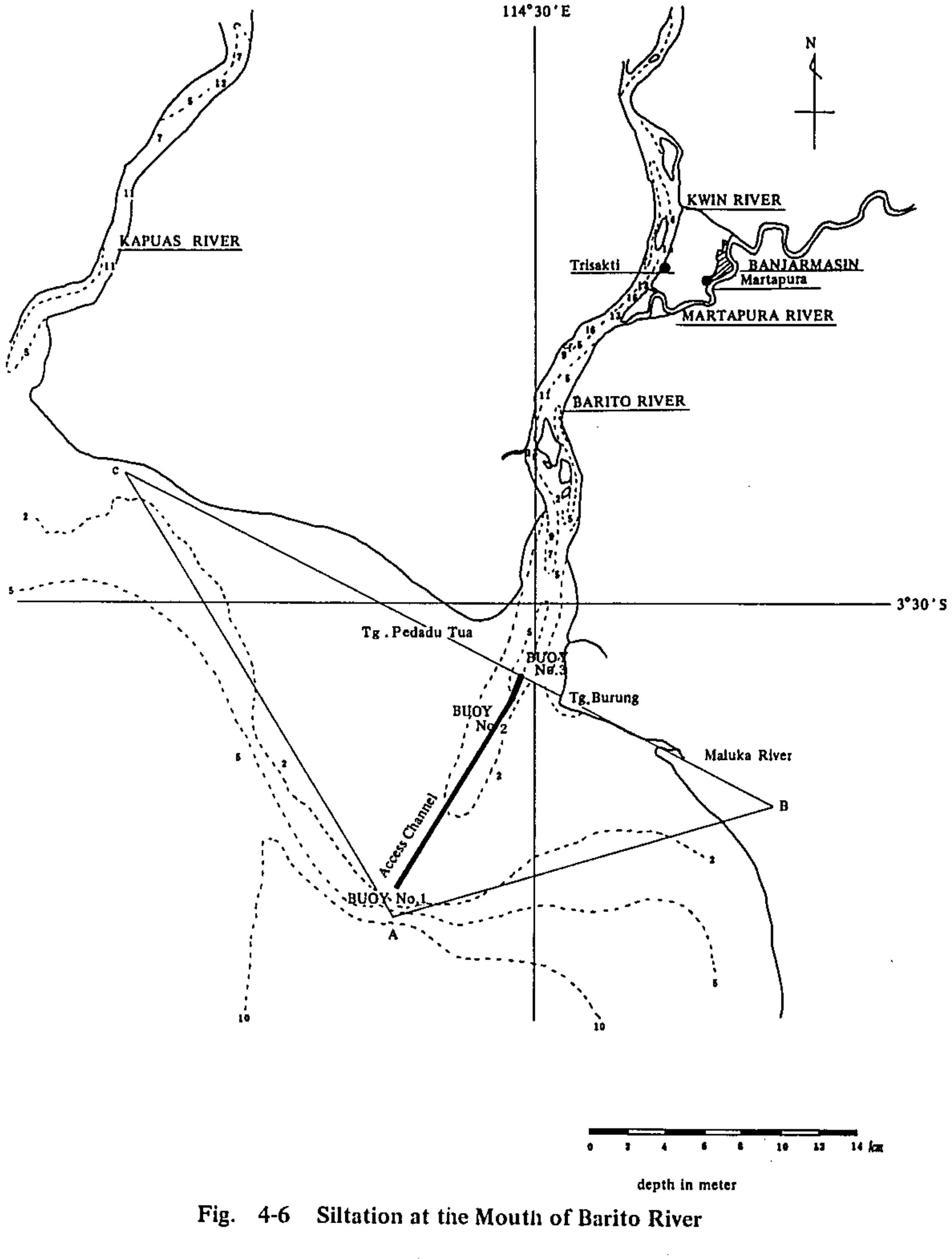
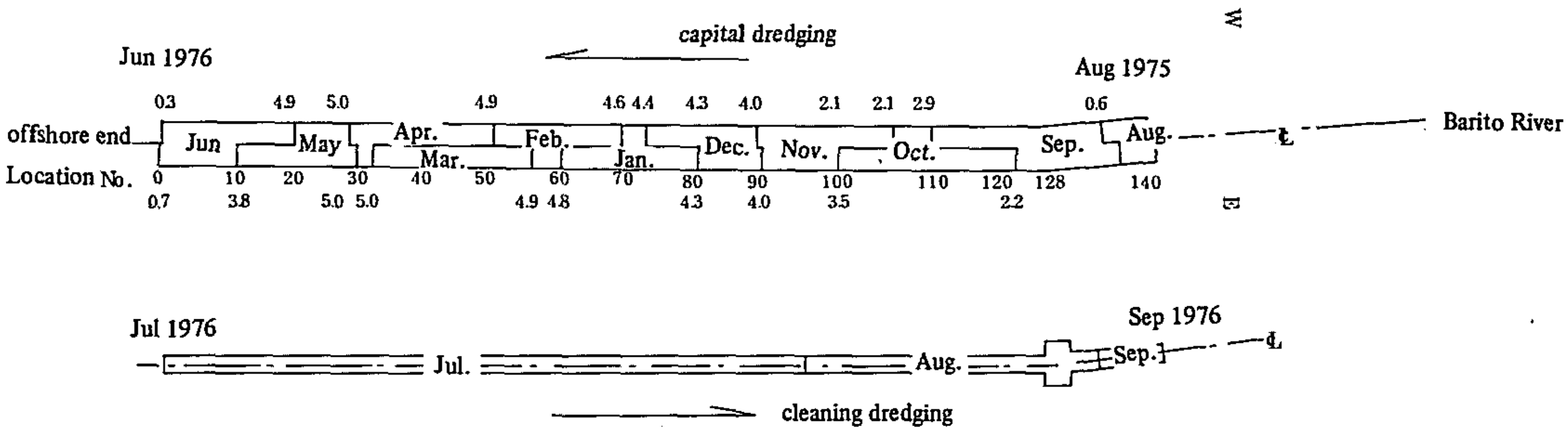


Fig. 4-6 Siltation at the Mouth of Barito River



−6.3m: depth dredged in the channel
Additional numbers mean dredged thickness

Fig. 4-7 Monthly Dredged Area

Table 4-4: **Silting Velocity (During Works)**

Water depth (m)	7	6	5
Silting velocity (m/month)	0.6 ~ 1.4	0.15 ~ 0.4	0.10 ~ 0.15

However, the dredging was started from the upstream wide, while the downstream side was kept blocked before completion of the work. With the access channel thus kept under such a special condition, the foregoing value can hardly be employed as an amount of siltation in the future.

Siltation is subject to the influences of the discharge of the river (in the rainy or dry season), waves (due to south-eastern or north-western monsoon), depth of the access channel (or economical depth), location (breaking waves or shallow water waves) and the tide (high or low tide). Now, referring to Fig. 4-8 and 9, the influence of the season and that of the location are related with each other, and they cannot be analyzed separately.

Before the sandbar at the river mouth was removed, the silting condition was dividable into two phases with the silting velocity of 0.1 m/month at about a depth of 5 m as a dividing point, and the silting velocity at places shallower than −5 m was far smaller than that at places of a depth of −5 m or more.

The slope of the access channel was planned at a gradient of 1/8, but the slope of the access channel along the measuring points 0 to 20 at the offshore side end where breaking waves might occur and that along the measuring points 120 to 140 where the river current might decelerate sharply were completed at a gradient of 1/10 respectively.

It is seen that the results of surveys and measurements performed prior to initiation of the dredging, during the work and after the completion provide important information for analysis of the mechanism of the siltation.

A cross-sectional view of the access channel showing characteristic changes in siltation is illustrated in Fig. 4-10.

Survey point No. 32 – Process for slope gradient to become gentle.
No. 44 – Sediment supply from the shallow water area on the eastern side.
No. 119 – Siltation occurring locally toward lower place in the access channel.
No. 122 – Sediment supply from the shallow water area on the western side.
No. 128 – Sediment supply on centrifugal current due to directional change and sediment supply from the shallow water area on the western side.

With the access channel divided into two parts, eastern and western, about the center line, seasonal change of the siltation in each part is illustrated in Fig. 4-11.

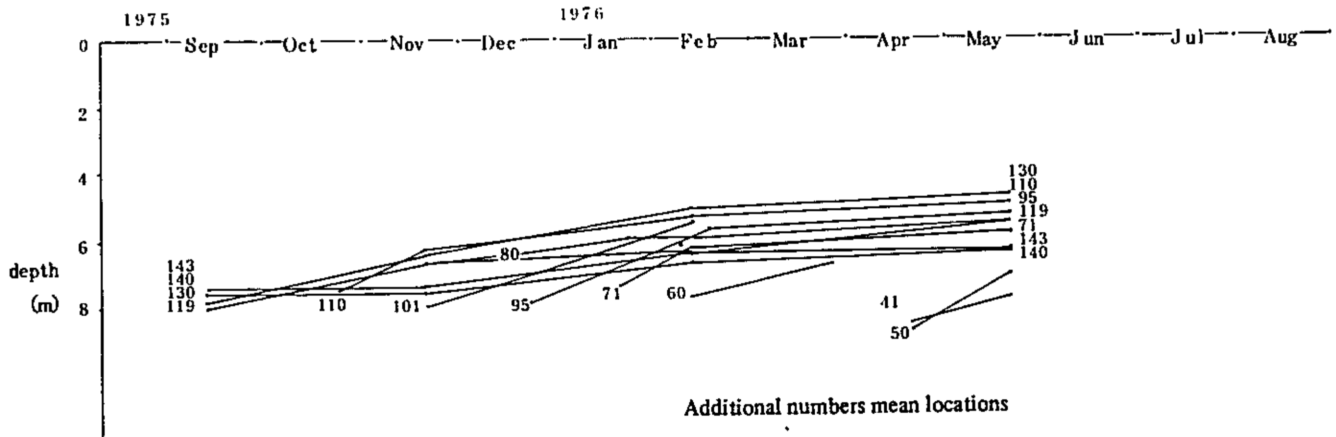


Fig 4-8 Monthly Change of Depth in the Channel

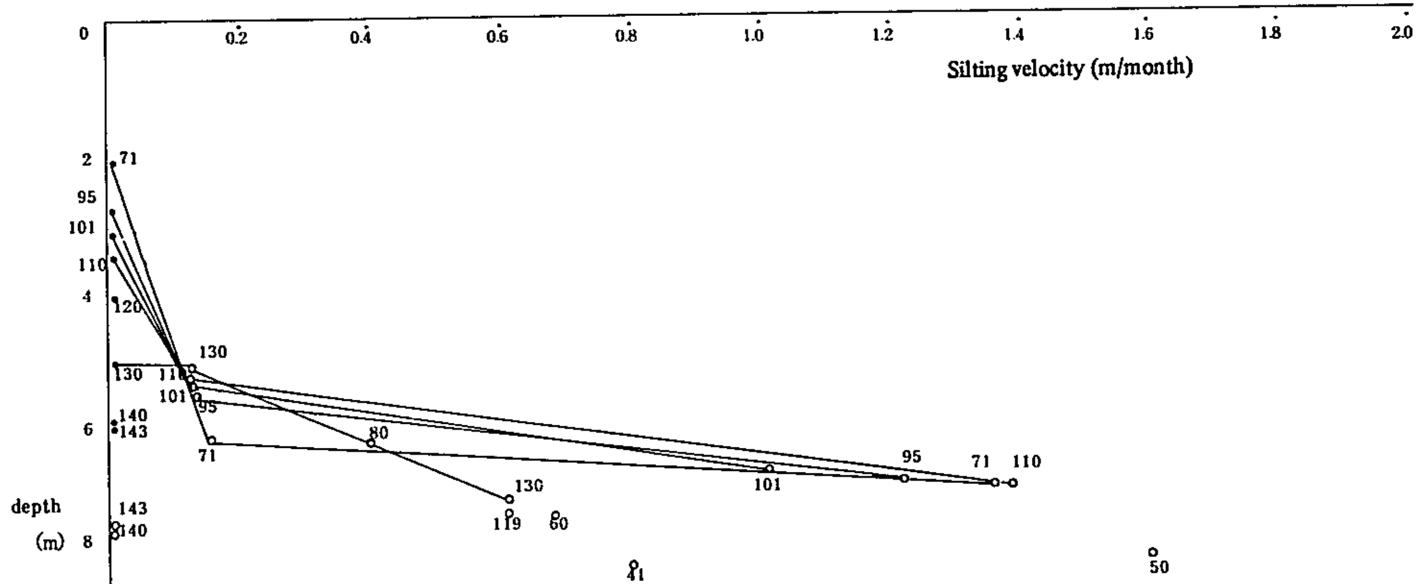


Fig. 4-9 Silting velocity (m/month)

Numbers mean locations
• initial depth

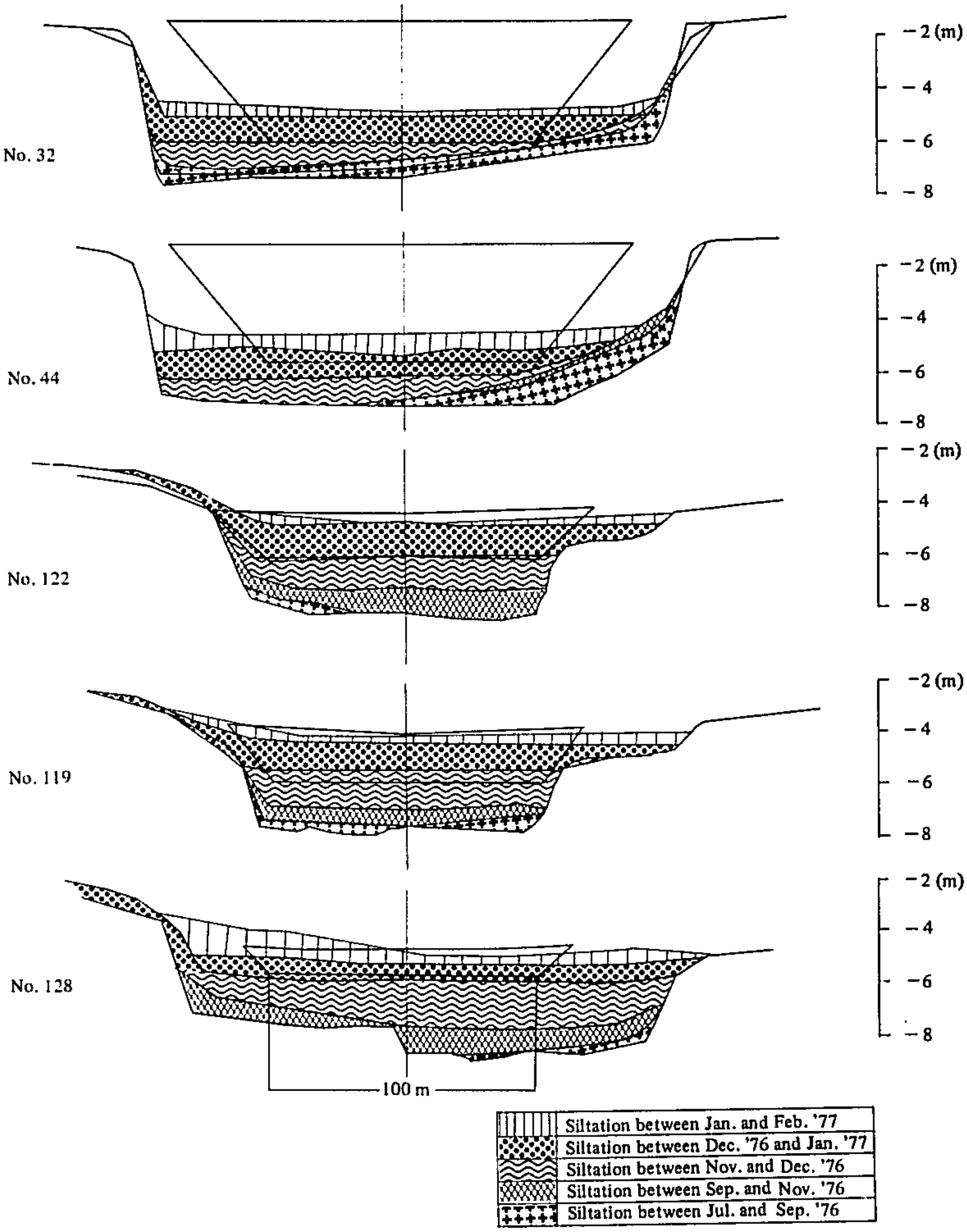


Fig. 4-10 Siltation in Access Channel

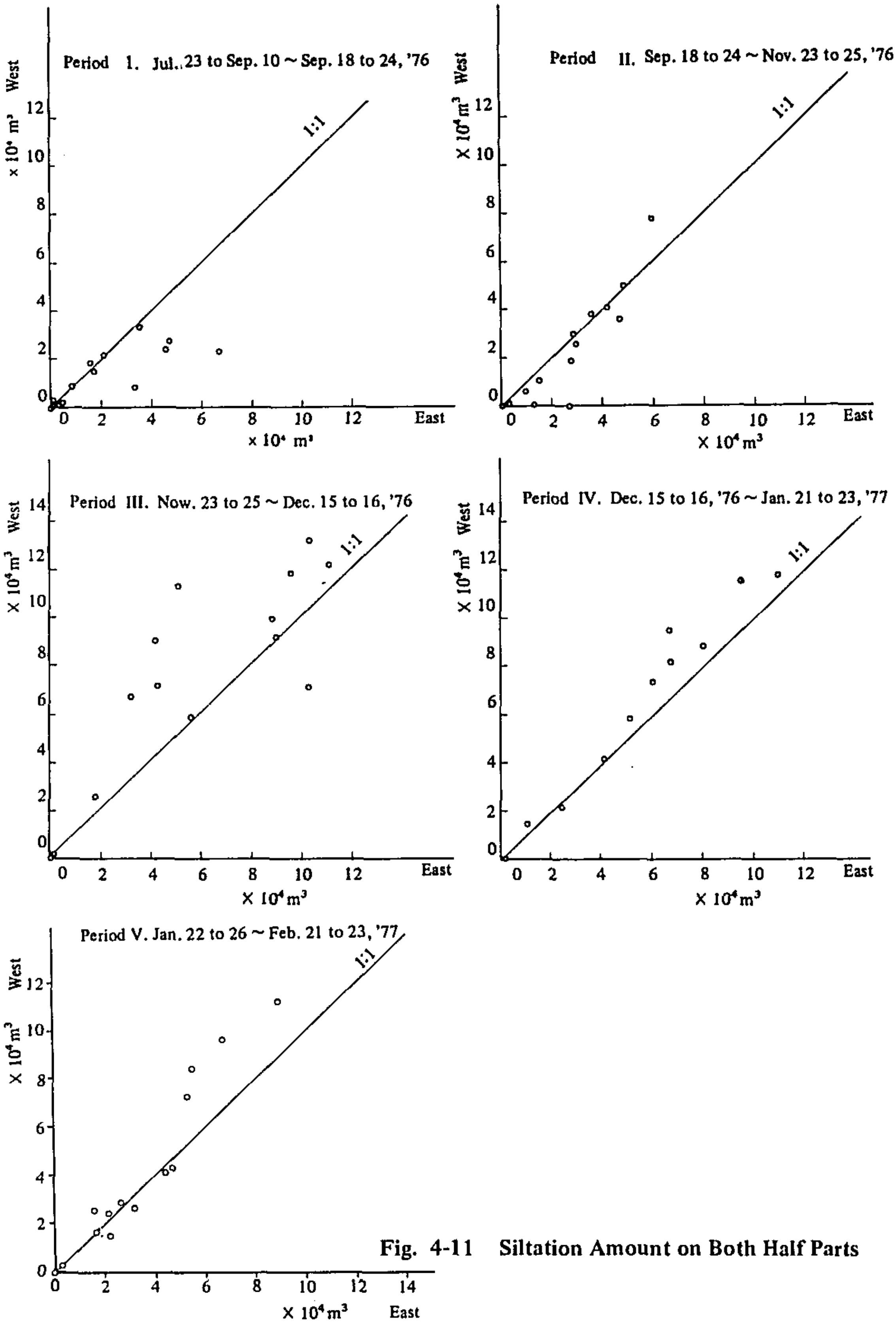


Fig. 4-11 Siltation Amount on Both Half Parts

The characteristics in the respective periods are as follows;

(1) Period I (July 23 to September 10, 1976) – (September 18 to 24, 1976): 15 – 60 days.

Siltation was not much and occurred mainly in the eastern half due to waves caused by the south-eastern monsoon.

(2) Period II (September 18 to 24, 1976) – (November 23 to 25, 1976): 60 days.

In this period, siltation occurred approximately evenly in the eastern as well as western part. The amount of siltation was also not much, next to Period I.

(3) Period III (November 23 to 25, 1976) – (December 15 and 16, 1976): 20 days.

Notwithstanding the relatively short period, siltation occurred mainly in the western half of the access channel by the wind and waves due to the north-western monsson.

(4) Period IV (December 15 and 16, 1976) – (January 22 to 26, 1977): 40 days.

The waves due to the monsoon were as strong as before, and the siltation was active, next to Period III. The siltation was lightly more in the western half of the access channel.

(5) Period V (January 22 to 26, 1977) – (February 21 to 23, 1977): 30 days.

The siltation is nearly the same as that of Period IV, if the difference in the number of days is taken into account.

The foregoing conditions of siltation reflect the seasonal changes of sea phenomena (wind and waves). But, it should be noted that the siltation is also affected more or less by the cross-sectional form of the access channel at the time of completion.

In the area close to the offing side end of the access channel where there is little influence of the flushing of river water, siltation was occurring continuously approximately at a constant rate (refer to Fig. 4-12).

Within the half range on the shore side of the access channel, siltation was active in the western half of the access channel due to the wind and waves caused by the north-western monsoon. But, in fact, siltation was accelerated by the unfavorable condition of water current in the access channel being blocked because of the siltation occurring in the offing half of the access channel.

When the above-mentioned Periods I through V are taken together, the siltation in the western half of the access channel in Period III is particularly noticeable (refer to Fig. 4-13). The siltation in this period was in a depth of about 2 m in the range of 10 km

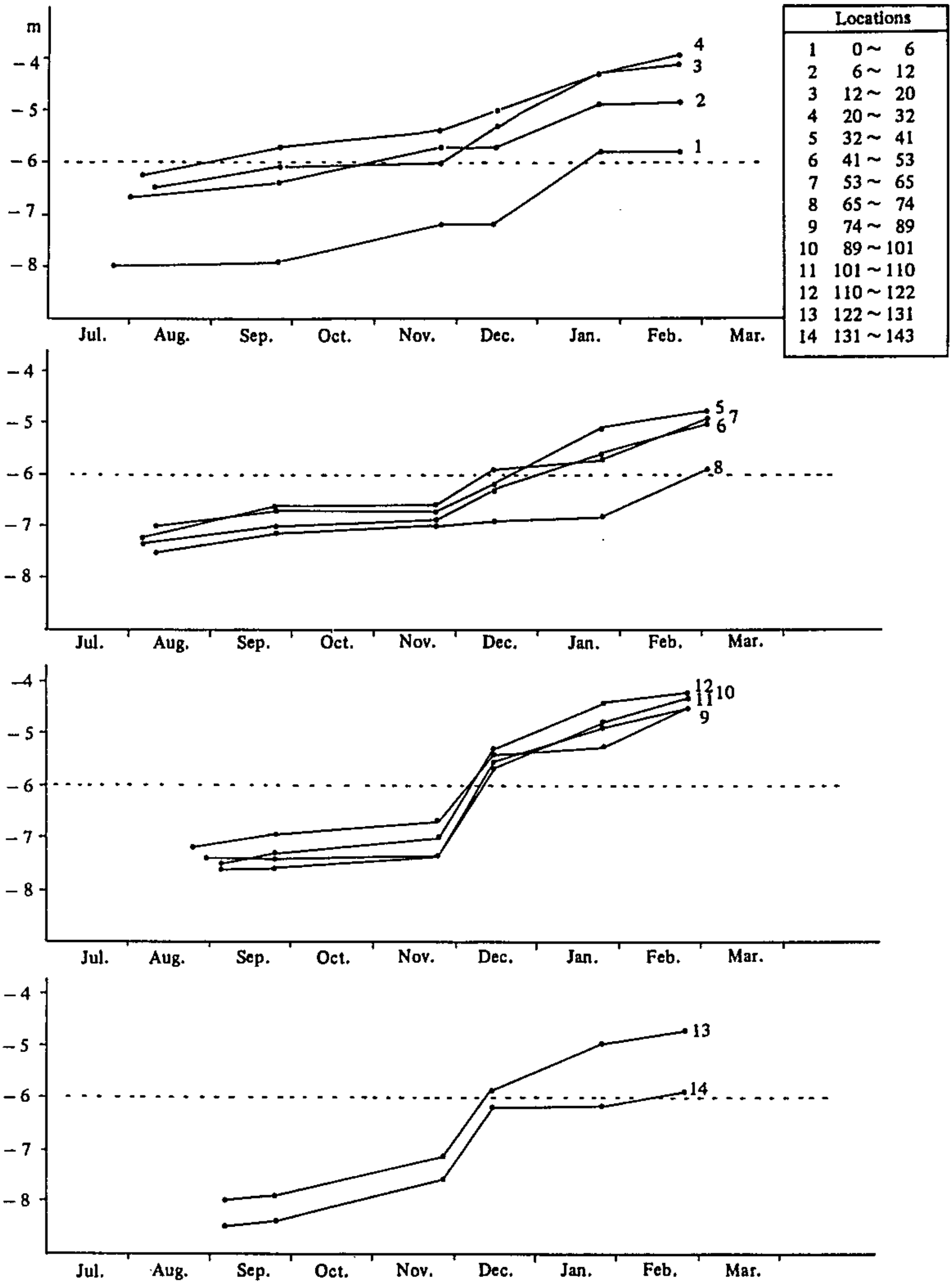


Fig. 4-12 Depth Change in the Channel

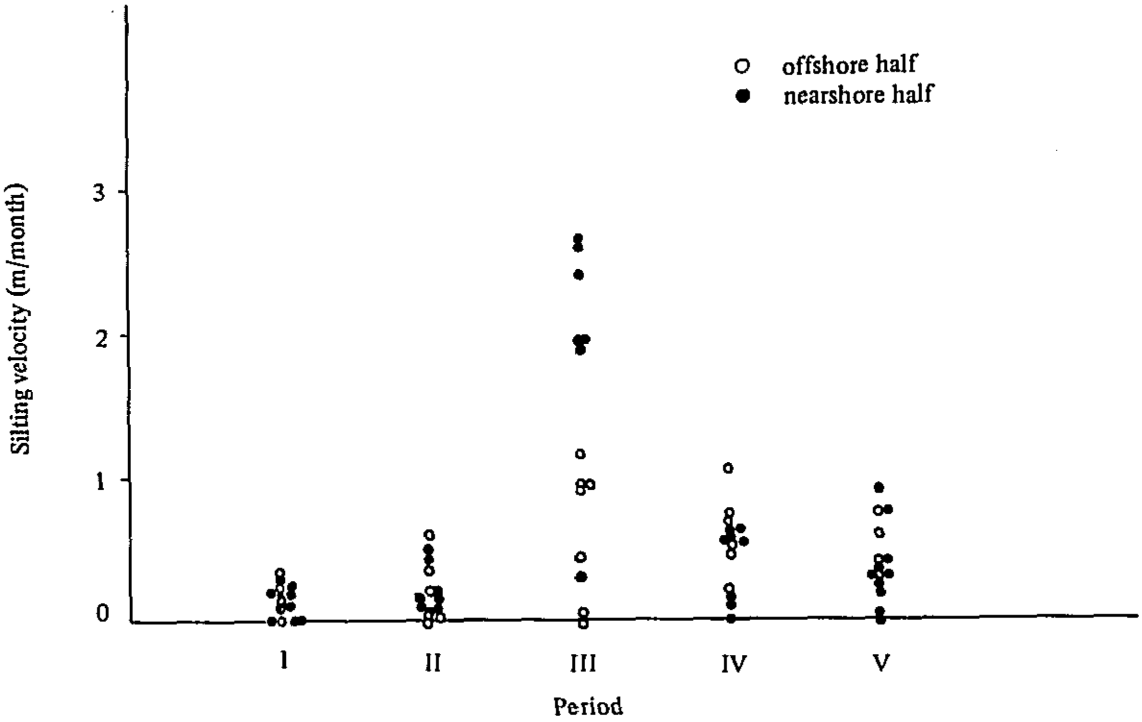


Fig. 4-13 Seasonal Change of Silting Velocity

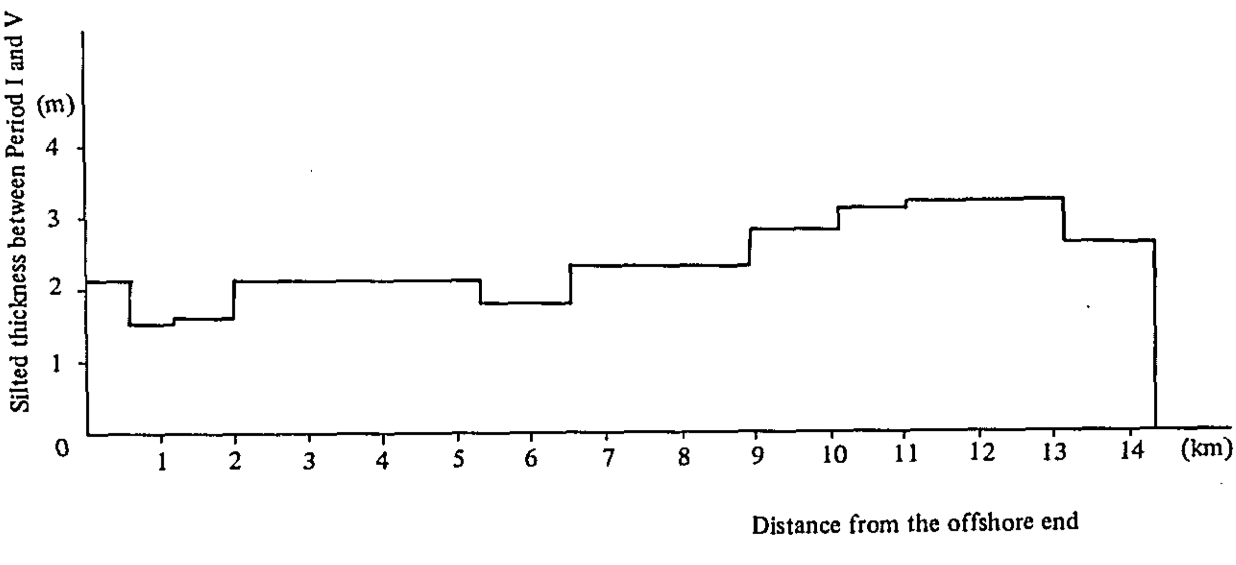


Fig. 4-14 Silted Thickness along the Channel

from the river mouth end or about 3 m in the remaining area of 4 km in the offing (refer to Fig. 4-14).

In general, the amount of soil to be dredged for maintenance is increasing with increasing design depth of the channel, but such increasing amount of soil to be dredged is covered under the overwhelming influence of the seasonal change and is hardly grasped.

The amount of siltation is also affected greatly by the content of soil in the river water flowing through the access channel or in the sea water.

Fig. 4-16 shows a relation of the size of soil particle versus the content of soil upon the results of investigation of the bottom material in the access channel at the Barito river mouth, dredged soil, silted soil and bottom material of the river. Coarse grained soils above fine sand form the original ground of the river as well as the access channel and are well compacted.

On the other hand, the content of soil in the dredged soil is 1/6 which corresponds to a water content of 500 percent, and thus the dredged soil is relatively loose.

As shown in Fig. 4-17 and 18, the concentration of soil particles in the sea bottom is varying under the influence of tides, and the soundings by sonar indicate the sea bottom rising up and down periodically

Sounding of the water depth of the access channel by a lead, it was underground about 1 to 1.5 m below the surface, showing a deeper depth than the echo sounder. (refer to Fig. 4-19). The lead passes through a very soft layer comprising organic matters, humus, floating mud and clay or silt or the so-called floating mud layer and stops at a relatively well compacted ground, thus sounding a deeper depth. As seen from Fig. 4-20, the depth shown by the lead is dependent upon the location, the condition of sea phenomena and the time of elapse after siltation.

4-3-4. Mechanism of Siltation

While the sand flowing down the Barito River and the littoral drift in the shallow water area repeat flotation and deposition in the access channel, it is thought that a considerable amount of deposited sand is floated up by the waves, current, etc. and swept away into the deep water area but the siltation in the access channel is caused by the remaining sand of deposition.

However, on account of the quantitative shortage of technical data so far available, insufficiency of the period for observation, etc., we have not been able to clarify the mechanism of siltation of the access channel completely.

Here, the condition of siltation that has been ascertained with the results of various surveys is outlined in the following.

(1) Results of survey at the mouth of Barito River

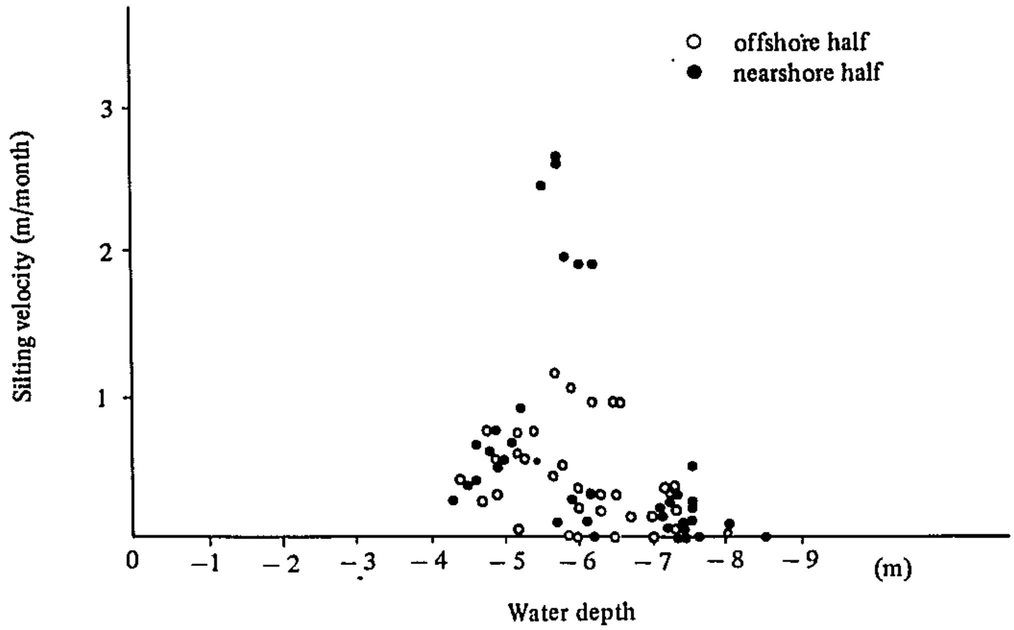


Fig. 4-15 Relationship between Silting Velocity and Water Depth

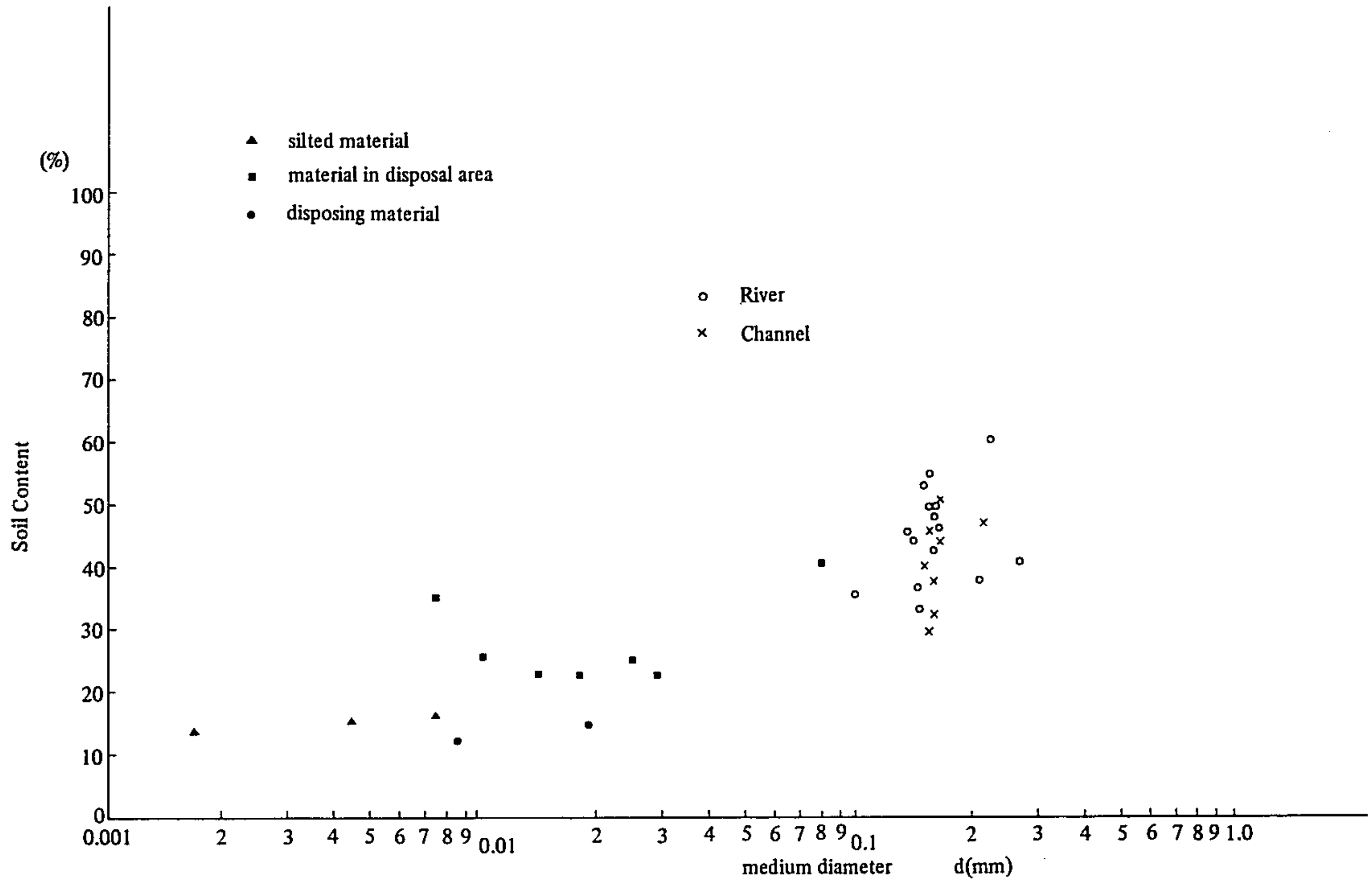


Fig. 4-16 Relationship between Soil Content and Medium Grain Size

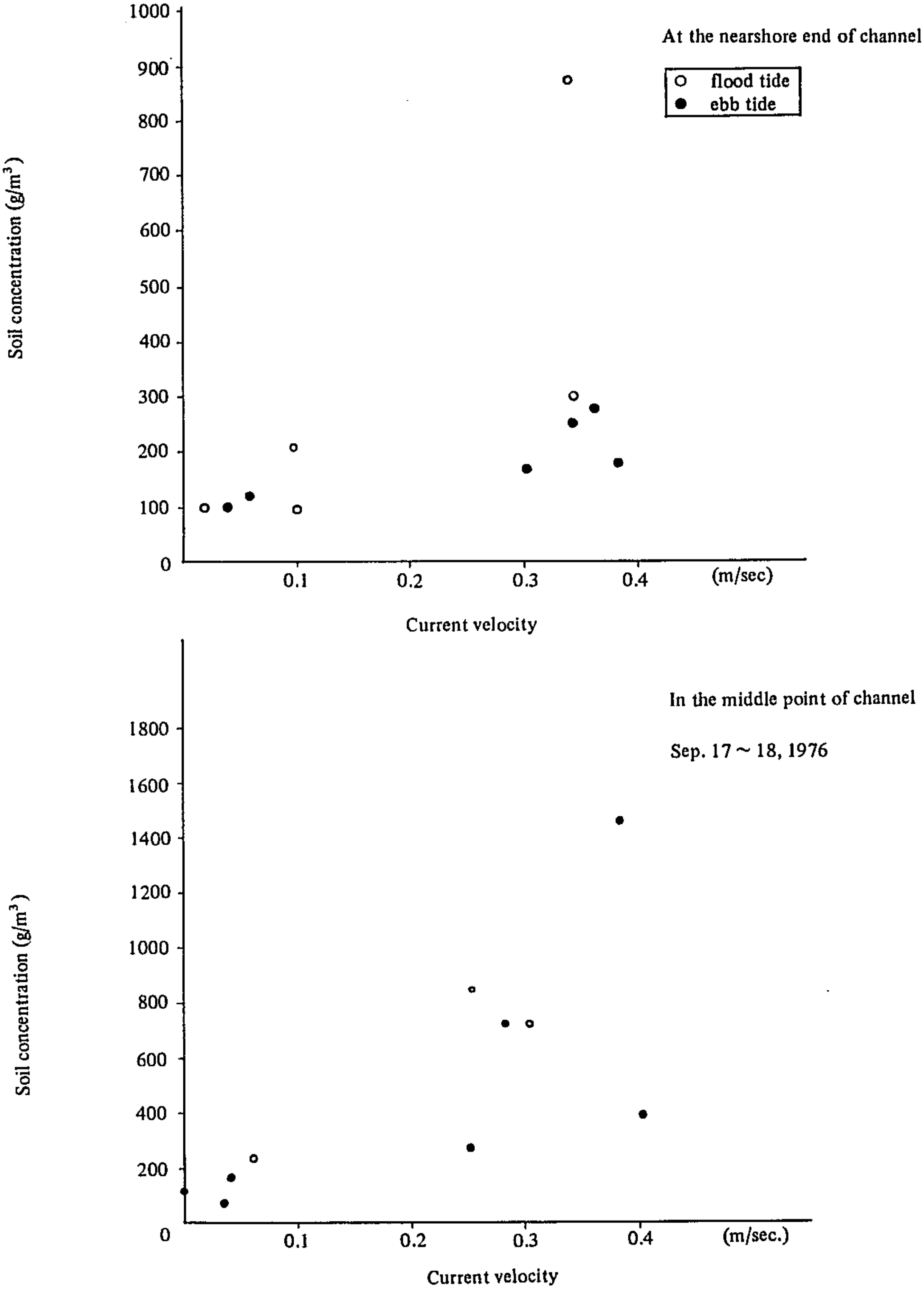


Fig. 4-17 Correlation between Current Velocity and Soil Content at the Bottom

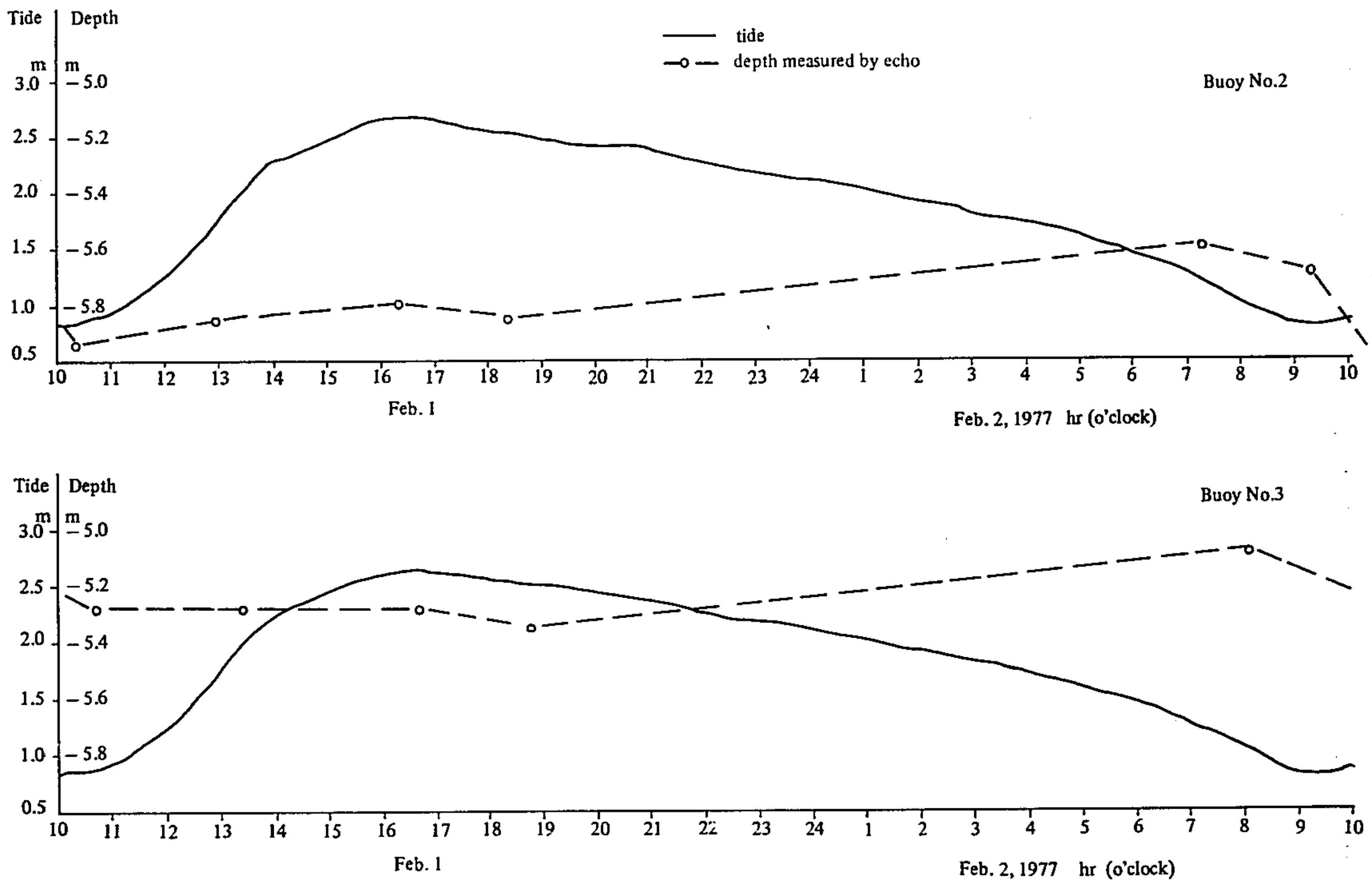


Fig. 4-18 Hourly Change of Depth

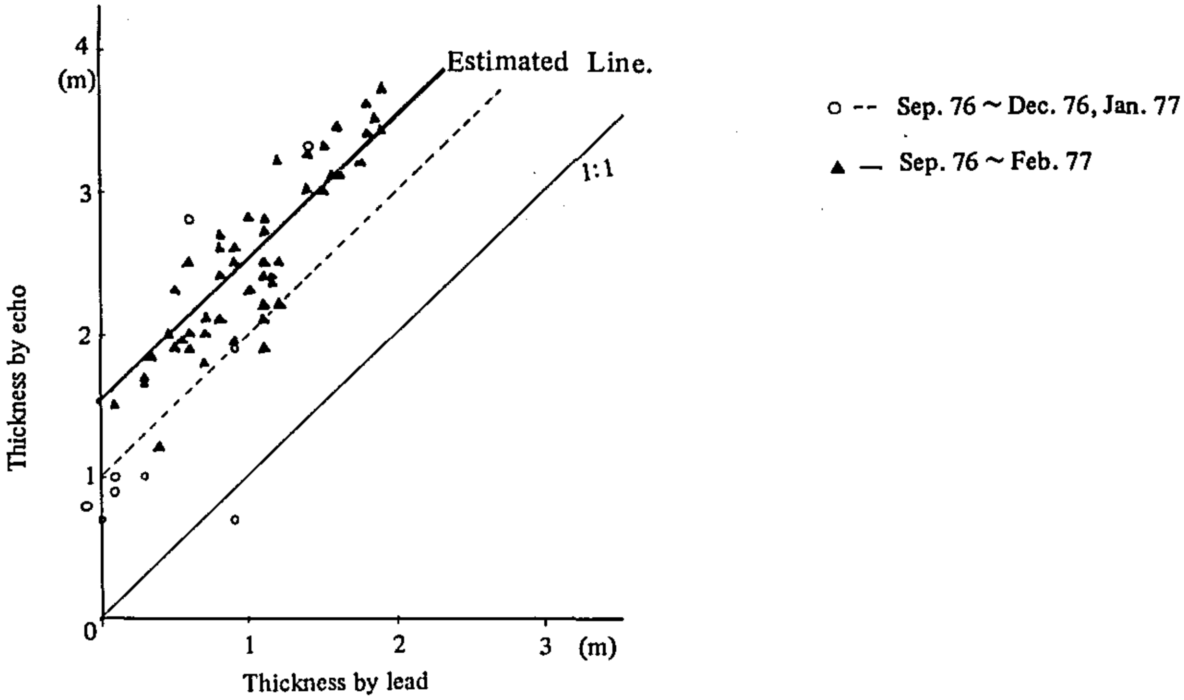


Fig. 4-19 Comparison of Silted Thickness Sounded by Echo and Lead

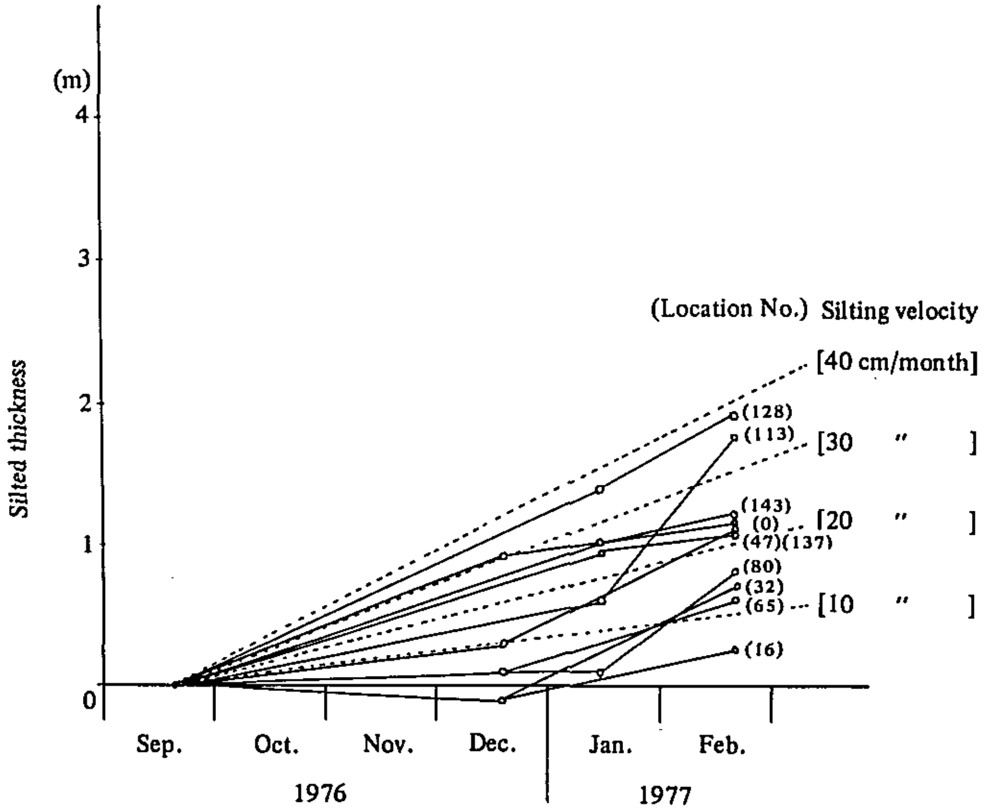


Fig. 4-20 Silting Velocity Sounded by Lead

1) The bed of the waterway is hard yet flexible and is composed of silty or sandy clay, and movement of the suspended material is scarcely observed.

2) The concentration of suspended material is about 50-90 g/m^3 with a smooth vertical distribution. This value is approximately the same with the amount of suspended material calculated from the shearing force at the bed, so that the suspended material is nearly close to equilibrium.

3) The current velocity shows a maximum value at the surface layer and is decreasing toward lower layer. Upon penetration of a salt wedge, the vertical distribution of current direction is no longer uniform, eddy currents being formed under the influences of the centrifugal force and salt wedge.

(2) Results of survey at the offing side end of the access channel.

1) At the time of ebb tide upon elapse of 15 hours after high tide, the river water flows through the access channel to the deep water area at a velocity of about 1 m/sec.

2) Under the tidal range of 1.8 m, the maximum velocity of current in the ebb tide is about 1 m/sec.

3) Salt content in the bottom layer of the access channel is not affected by the inflow of river water at the time of ebb tide and is almost the same as that of sea water, whereas in and around the surface layer, fresh water is intermixed at the time of low tide with the mean value of fresh water intermixing in the vertical section at about 10%.

4) The current direction and velocity are governed by the general current in the shallow water area which is approximately normal to the access channel. Thus. the effect of tidal current is predominant so that the flushing effect is not expected.

5) The soil concentration varies little with the tide: at about 10 g/m^3 in the surface layer and 100–300 g/m^3 in the bottom layer. These values are considerably less than that of the concentration in the shallow water area at about 500–3,000 g/m^3.

(3) Supposed Mechanism of Siltation

1) What is considered to be most influential upon the siltation of the access channel is the suspended material stirred up by waves in the shallow water area on each side of the access channel and carried on the tidal current into the access channel.

2) Part of the suspended material flowing into the access channel deposits in the access channel, while a greater part is flowed through the access channel and flushed out to the deep water area by tidal current.

3) The suspended material flowing into the access channel contribute to the siltation as they are pushed back toward the shore at the time of a flood tide, coagulated and rapidly precipitated at the border area with the penetrating salt wedge probably by the addition of electro-chemical action.

4) In the access channel, the currents and waves tend to cause the bed materials in an unstable condition to active flotation. As the bed materials float up into water, they are diluted with a mass of water so that there is little change or decrease in the apparent volume of suspended material as compared with that during the work period.

5) The floating mud forming the upper layer of the silted soil seems to move under the influence of the tidal current.

6) The suspended material flowing into the access channel from both sides through mass transport by the waves at the time of the north-western monsoon seems to constitute a great factor for the siltation of the access channel.

4-3-5. Annual Amount of Siltation

Estimation of the annual amount of siltation in the access channel is made upon the results of past surveys so far as available.

(1) Period during July 25 to September 20 (Period I)

After completion of the dreging works of the access channel, depth sounding was carried out mainly of the access channel from the offshore end to the shore side end during the period of July 23 to September 10 except the days of stormy weather.

Along with the result of this survey, the silting velocity of the access channel during the period of two months including the periodof one week from September 18 to 23, 1976 under the influence of the south-eastern monsoon, is illustrated in Fig. 4-21.

Siltation of the access channel during this period is summarized as follows.

1) The half portion on the land side of the access channel was scoured at an average deepening velocity of 0.10 m/month, and no siltation occurred.

2) In the half portion on the offing side of the access channel, siltation occurred at an average silting velocity of 0.16 m/month.

3) The annual amount of siltation could be calculated, having a tendency of siltation as follows;

Mean silting velocity:	0.16 m/month
Period:	2 months

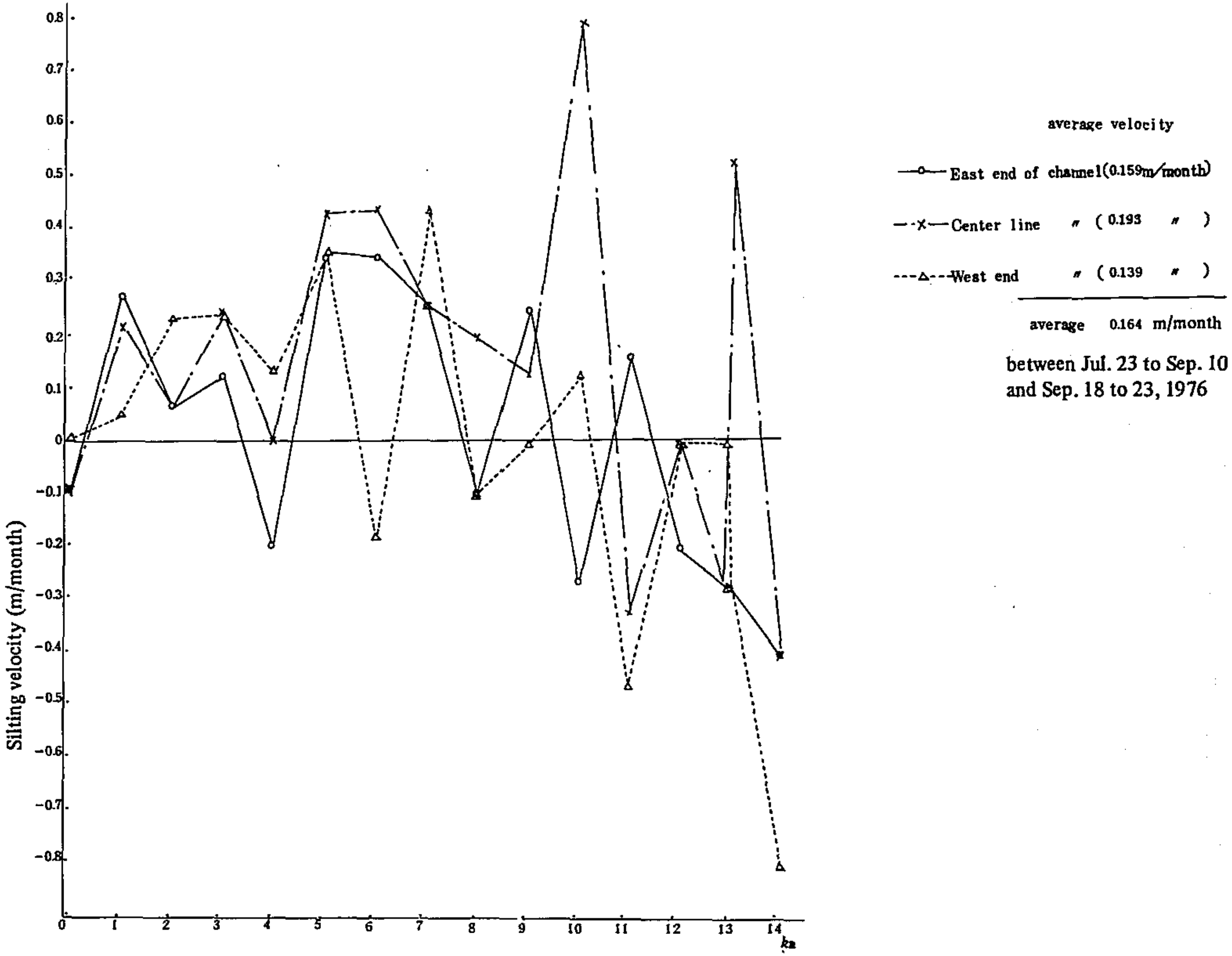


Fig. 4-21 Monthly Silting Velocity

Width of Access Channel: 100 m
Extension of Access Channel Silted: 7 km

$0.16 \text{ m/month} \times 2 \text{ months} \times 100 \text{ m} \times 7 \text{ km} = 220{,}000 \text{ m}^3.$

In the calculation, it was assumed that immediately after completion of the access channel, the siltation would be consisting of relatively coarse grained soils so that presence of the floating mud would be neglected.

Table 4-5 Amount of Siltation
(After dredging work was completed)

Period	Silting Velocity (m/month)	Siltation Amount (m^3/month)
Jul. 1976 – Sep. 1976	0.16	220,000
Period	Average silting thickness (m)	Siltation amount (m^3)
Sep. 1976 – Jan. 1977	2.22	3,170,000

(2) Period during September 20 to January 30 (Period II)

1) The total amount of siltation during the period of 135 to 180 days from July 23 – September 10, 1976 to January 22 – 26, 1977, was calculated upon the sounding datas by the echo sounder as 4,500,000 m^3. In the access channel of the width of 100 m, it was calculated as 3,000,000 m^3, including 800,000 m^3 of siltation in the shallower area than the design depth of –6 m in the access channel.

2) The access channel slope having a maximum gradient of 1/2 had no appreciable collapse observed after elapse of the predominant seasons of south-eastern and north-western monsoon.

3) The floating mud observed in the Barito River was covering the surface of the siltation in the access channel in a thickness of 1 to 2 m, but from the condition of suspension of the particles and viscosity of the floating mud itself, it would not impede the navigation of vessels directly. Thus, it would be realistic that the amount of maintenance dredging might have close relation to that of substantial siltation excepting floating mud.

Upon the results of sounding in this period, the amount of siltation is obtained as 3,170,000 m^3. Now, taking the surface layer and regarding the layer of 1 m below the surface as the floating mud during the period, this should be deducted, then there is obtained a substantial amount of siltation as follows;

$$3{,}170{,}000\ m^3 \ - \ 1{,}430{,}000\ m^3 \ \fallingdotseq \ 1{,}740{,}000\ m^3.$$

(3) Period during January 23 to July 25 (Period III)

1) There is no past record of sounding surveys corresponding to this period so that it is not practicable to estimate the amount of siltation upon the result of surveys as in the case of Period I or II.

Then, it was assumed that the siltation would show the same tendency as that during the dredging work given monthly in Table 4-6 in estimating the amount of siltation.

Table 4-6 Amount of Siltation
(Period of dredging work)

Period	Siltation amount (m^3)
Aug. 1975 – Sep. 1975	190,000
Sep. 1975 – Jan. 1976	2,667,000
Jan. 1976 – Jul. 1976	1,872,000
Total	4,729,000

2) The estimated amount of siltation during the period of September 20 to January 23 is calculated as 1,740,000 m^3 in the case of Period II, and the substantial amount of siltation during the work period corresponding to Period II was 2,667,000 m^3. It is assumedly that the proportion of the estimated amount of siltation to the substantial amount of siltation during the work period is constant. Accordingly the amount of siltation during the present period can be estimated on the basis of the substantial amount of siltation during the work period corresponding to the period of January 23 to July 25, or 1,872,000 m^3. So, the estimated amount of siltation during this period is calculated as 1,220,000 m^3, as follows;

$$1{,}872{,}000\ m^3 \ \times \ 1{,}740{,}000\ m^3/2{,}667{,}000\ m^3 \ = \ 1{,}220{,}000\ m^3.$$

It is presumed from the result of longitudinal survey of the access channel that the layer of the floating mud has had the thickness increased by 0.5 m average during this period. This being deducted, the substantial amount of siltation is estimated as 500,000 m^3.

$$1{,}220{,}000\ m^3 \ - \ (1{,}430{,}000\ m^3 \times 0.5) \ = \ 500{,}000\ m^3.$$

(4) Annual Amount of Siltation

The annual amount of siltation is obtainable as the sum of the estimated amounts of siltation during the Periods I, II and III. Thus, the estimated annual amount of siltation is approximately 2,500,000 m^3.

$$220{,}000\ m^3 + 1{,}740{,}000\ m^3 + 500{,}000\ m^3 \fallingdotseq 2{,}500{,}000\ m^3.$$

4-3-6. Implementation of Maintenance Dredging

(1) Implementation method of Maintenance Dredging

1) Adequate Dredger

For maintenance dredging of the access channel, a trailing hopper suction dredger is considered to be optimum in that it causes no hazard to the vessels navigating the access channel, that it is operative in waves of a considerable degree, that it requires no soil carrier in dredging and that it has no limitation in the distance of transport of the soil for dumping.

2) Size of Dredger

To maintain the depth of the access channel at −6 m, it is required, in consideration of the operation, to limit the draft of the dredger to about 5 m, and a vessel with a hopper capacity of about 1,000 m^3 to 1,500 m^3 is considered to be appropriate.

3) Time of Implementation

The performance of the dredger having a hopper capacity of 1,000 m^3 to 1,500 m^3 may vary with the property of the soil to be dredged, but it is generally estimated to be about 1,500,000 m^3 to 2,000,000 m^3 per year so that when the estimated annual amount of siltation is taken into account, the dredger will have to be operated throughout the year.

(2) Examination of the Method of Maintenance Dredging

1) Dredging of the Whole Area of Access Channel

As the turbulence due to navigating vessels and constant dredging of the places of siltation serve for reducing the velocity of compaction of the floating mud, an increase is expectable of the amount of soil carried out of the access channel on the current. It is, therefore, desirable to watch the whole area of the access channel constantly and perform dredging as soon as siltation occurs.

2) Maintenance of Depth during Daytime

The tidal level in the daytime during which navigation is allowed is highest in may and lowest in November. Therefore, the annual dredging plan should be formulated with consideration that a water depth of 6 m is insured throughout the access channel in or around November.

3) Method of Maintenance dredging

Maintenance dredging is carried out for about 3 km in the teeth of current at one operation, with the width of about 1.5 m and the depth of about 0.3 m. Since the length of dredger is about 70 to 80 m, it requires that the turning basin is provided of the radius of about 80 m at an interval of about 3 km along the access channel.

(3) Requirement of Partial Dredging

If siltation occurs at a place that may hinder flow of the current in the access channel, it tends to accelerate siltation over a considerable range of the access channel. Therefore, in the event of a local siltation, such soil should be dredged immediately.

(4) Dumping Place

Both sides of the access channel being shallow, effective dumping of the soil is not practicable with the trailing hopper suction dredger, and the soil blown off onto the sides of the access channel may come back into the access channel by the current or wave to accelerate the siltation. It would be appropriate to be dumping place at a location about 5 km in the offing of the offshore end of the access channel with a depth of about 20 m.

(5) Dredging at the Offshore End

Siltation at the offshore end in the season of north-western monsoon may trigger siltation over the whole area of the access channel. Dredging at the offshore end thus serves for reducing the amount of soil in maintenance dredging, while the offshore end is located closer to dumping place so that the frequency of dredging may be increased to the advantage of improving the work efficiency.

(6) Dredging at the End on the River Mouth side

In the shallow water on both side of the access channel, the waves generated by the north-western monsoon are apt to cause a considerable extent of siltation. However, the sweeping effect by the current is expectable to some extent. Thus while the dredging at the offshore end is carried out appropriately, consideration should be given to reducing, so far as practicable, the amount of maintenance dredging in this area which is of a long distance from dumping place.

For reference, a plan of maintenance dredging in this access channel is illustrated in the following.

(1) Conditions

1) Mean distance of transport

Center of the access channel – Offshore end;	7 km
Offshore end – Dumping place;	5 km
One way	12 km (Both ways 24 km)

2) Water depth to be maintained: –6 m.
3) Access channel width: 100 m
4) Soil quality: Silt, clay and floating mud.
5) Amount of siltation: 2,500,000 m^3.

(2) Dredger

1) Hopper capacity: 1,200 m^3.
2) Pump capacity: 3,500 m^3/hr x 2 units = 7,000 m^3/hr.
3) Soil content (Apparent): 35% (Proportion of the natural ground to the hopper capacity).
4) Workable limit: Wave height at 1.5 m.
5) Vessel type: Length; 7.5 m, width; 12 m, and draft; 4.5 m.
6) Navigational speed: In dredging – 3 kt (5.4 km/hr.)
In sailing – 10 kt (18 km/hr.)

(3) Dredging Operation

1) Dredging time:

Up to full loading	–	10 mins/operation
Overflow time	–	20 mins/operation
Total		30 mins/operation

2) Navigation time: 24 km ÷ 18 km/hr
= 1 hr 20 mins/operation.
3) Time required for dumping: 10 mins.
4) Total required time: 30 mins + 1 hr 20 mins + 10 mins
= 2 hrs/operation.

(4) Work Schedule

1) Work: In the unit of one week (Monday through Saturday) – Sunday is holiday
2) Maintenance: 1 day/week (Sunday allocated) or 52 days/year.
3) Maintenance: 30 days/year
4) Repair: 2 days/month or 24 days/year.
5) Stormy weather: 10 days/year
6) Other suspended days: 10 days/year
7) Unworkable days: 126 days/year (sum of 2) to 6))
8) Working days: 365 – 126 = 239 ≒ 240 days/year
(240 days/year = 20 days/month.)
9) Working hours: 24 hrs/day.
10) Number of operations: 24 hrs/day ÷ 2 hrs/operaton
= 12 operations/day.

(5) Amount of dredged soil

1) Amount of dredged soil with water:
   7,000 m^3/hr x 0.5 hr/operation = 3,500 m^3/operation
2) Amount of dredged soil (Soil content, 30%):
   3,500 m^3/operation x 0.3 = 1,050 m^3/operation.
3) Effective amount of dredged soil
   The maximum content of the soil in the hopper is about 60% of the hopper capacity;
   1,200 m^3/operation x 0.6 = 720 m^3/operation.
4) Overflow soil:
   Overflowed amount of soil, a part of which moves on the current and is discharged out of the access channel;
   1,050 m^3/operation – 720 m^3/operation = 330 m^3/operation.
5) Annual amount of dredged soil;
   720 m^3/operation x 12 operations/day x 240 days/year
   = 2,070,000 m^3/year, or about 2,000,000 m^3/year.

4-3-7. Guideline for Future Survey

In order to establish an adequate counterplan against the siltation of the access channel and for appropriate excecution of the maintenance dredging of the access channel, it is important to continue surveys including periodic soundings so that the mechanism of siltation in the access channel will soon be resolved.

(1) *Measurement of Depth*

The siltation velocity in the access channel is subject to the influences of the void ratio and water content of the deposited soil, waves, discharge of the river, tidal currents, salinity, etc.

Usually, the condition of siltation varies constantly with time. Here, what is most important in estimating the amount of siltation and thus planning an economical maintenance dredging is the periodic sounding, and this work is indispensable not only for analysis of the mechanism of siltation but for precisely grasping the condition of siltation. For measurement of the depth, a lead or a echo sounder of an appropriate frequency and output should be used in that it represents the depth correctly without being influenced by the flow of floating mud.

It will also be required for check of the floating mud to execute the works for grasping the actual condition, such as the collection of the bottom materials, the data by lead.

(2) Hydraulic Survey

For the purposes of clarifying the mechanism of siltation, formulating an appropriate dredging scheme and examining the practicability of increasing the depth and expanding the width of the access channel in the future, hydraulic surveys of the waves, tidal current, etc. along with the sounding survey should be carried out continually.

For the tentative surveying and observing plan, the following proposal is submitted by the experts, Mr. Suzunai and Mr. Yagyu, may be adopted appropriately.

1) Monthly sounding

Using the echo sounder, monthly sounding shall be carried out in a longitudianl direction along the access channel.

2) Sounding in the vicinity of fence

Monthly sounding shall be carried out in the vicinity of the wooden fence provided at 1.5 km apart to the west from the access channel.

3) Three monthly sounding

Survey of the cross section of the access channel shall be carried out by a spacing of 300 m and an interval of 3 months.

4) Current survey (Determination of salinity and suspended matters)

At each end and the center of the access channel, observations shall be carried out for 25 hours, with a frequency of each one time at spring and neap tides respectively in the rainy as well as dry season.

5) Survey of silted soil

The soil at the sea bottom shall be collected and its density, composition, etc. shall be investigated.

6) Observation of tidal levels

The mean water level being high in the rainy season and low in the dry season because of the varying river discharge, tidal levels including change with year shall be observed.

Chapter-5

Long Term Development (PLAN-II)

CHAPTER 5

LONG TERM DEVELOPMENT (PLAN - II)

5-1. Introduction

5-1-1. Based on the state of development of the port service area that is believed to be attained in the year 2000 A.D., this article describes the outline of the Banjarmasin port development project to cope with these development.

5-1-2. The amount of cargo which will be handled at the Banjarmasin Port in the year 2000 A.D. is estimated, as studied in Chapter 3, a total of 7,540,000 tons.

Of these, as shown in Table 5-1, cargo that should be handled by the new wharf planned is 3,740,000 tons, the petroleum product to be handled by the dangerous cargo pier (PERTAMINA facility if continued as is) to be 1,500,000 tons and cargo such as ore, processed timber etc. to be handled on the river basin to be 2,300,000 tons.

Taking into consideration the fact that the estimated volume and quality of these products may be exceeded in the year 2000 A.D., facilities should be planed with reserve and consideration should also be given to leaving leeway for defelopment beyond the year 2000 A.D.

5-1-3. As it was extremely difficult to predict the conditions of technical revolution and state of shipping in Indonesia and the world in the year 2000 A.D., and as its reliability must inevitably be low, facility planning for the year 2000 A.D. was carried out on the assumption that shipping conditions would be the same as in 1983 as described in Chapter 6. Sufficient leeway has been incorporated in this plan for future development as explained in Paragraph 5-1-2 to cope with any future changes in shipping conditions.

5-1-4. The present Banjarmasin port is divided into the outer port area (Trisakti Wharf) and the inner port area (Martapura Wharf), each port area performing different functions. Since it is expected that the quantity of cargo in 2000 A.D. will increase about 6.4 times as much as that in 1975 and that the population of Banjarmasin city in 2000 A.D. will increase about 2.6 times as much, it is considered difficult to maintain the present inner port as it is where both land area and water area are narrow.

Accordingly, based on the conception that the present inner port area is concentrated to the outer port area at least in 2000 A.D. and that the site should be amalgamated to a new re-development plan which will link with the market functions of the urban area, the facility plan was made in this planning.

5-2. Selection of Projected Port Site

5-2-1. Although dredging of the sand bar at the estuary of the Barito River has been completed and a channel provided through which large vessels with drafts up to 6 meters

Table 5-1 Estimated Volume of Cargo to be handled at Banjarmasin Port in 2000 A.D.

Unit: 1000 tons

Kind of Cargo	Total Volume of Cargo	Place of Loading and Unloading				Remarks
		Wharf		Mooring Basin	Oil Terminal	
1) Exports	2,300	800	(690)	1,500		
Logs	-	-	-	-		
Processed timber	700	-	-	700		
Rubber, Other Estate Crops	360	360	(250)	-		225 out of 360 is palm oil
Minerals	800	-	-	800		
Others	440	440	(440)	-		
2) Imports	240	240	(240)			
3) Outbound domestic	1,800	1,000	(650)	800		
Processed timber	800	-	-	800		
Others	1,000	1,000	(650)	-		70 out of 1,000 is palm oil
4) Inbound domestic	3,200	1,700	(1,470)	-	1,500	
Oil	1,500	-	-	-	1,500	
Others	1,700	1,700	(1,470)			
Total	7,540	3,740	(3,050)	2,300	1,500	

Note (   ): equivalent general cargo volume.

are capable of passing, as the depth of the water in the river itself is not uniform, when seeking a suitable port site, it will be necessary to select a site where large vessels are capable of berthing safely and easily. As shown in Figure 5-1 the river is divided into two branches by the Kembang Island and flows down stream in a gentle curve. However, at this point, a gut runs along the east bank which forms the outer side of the curve and, as a water depth of over 10 meters is maintained naturally up close to the bank for a distance of approximately 7 Km from the mouth of the Kwin River to the mouth of the Martapura River (Trisakti Wharf located midway), this is considered the most suitable location for large vessels to berth.

As the width of the river near the lower part of Kembang Island is 800 to 900 meters in width and as there is also a separate gut of 5 to 6 meters in depth along the west bank, it is believed that this area would be highly sutiable for anchorage of large vessels in the future.

The gut shifts away from the east bank and moves towards the west bank at about the point where it passes the mouth of the Martapura River and, after passing the west side of Kaget Island, it runs along the center of the river and flows into the Java Sea along a new channel. The gut does not approach the east bank again below the portion explained above.

5-2-2. Since, near the estuary of Barito River, there is a shoal of about 1 meter in depth which extends far out of the sea, the approach of large vessels is impossible unless a large-scale dredging is carried out in order to establish adequate access channel and basins. Without the dredging, the estuary will be difficult to become a site suitable for a port and harbor construction. Looking at the navigation in Barito River, it is found that there is almost no problem to the navigation of large vessels from the estuary to the present Trisakti Wharf – approximately 25 kilometers between the two points since the river runs smooth and is wide and deep.

5-2-3. Martapura River flows into the Barito River at the point of approximately 3.3 Km downstream from the present Trisakti Wharf. A short cut has also been cut approximately 1.7 Km downstream connecting Barito River with Martapura River

The topography is extremely complicated near the mouth of the Martapura River and the shortcut due to the meandering flow, however, as the width of the river is between 70 to 150 meters and its depth 4 meters in the shortcut and about 10 meters in the mainstream, it will be very effective to plan mooring facilities for small and medium type ships along this waterway. Also, as abundant water line is available in this area, it is highly suitable as an industrial area for timber processing etc. that require a water line. It will therefore be possible to plan coordinated usage of land together with the port area upstream.

5-2-4. Results of surveys carried out by means of 6 borings made in the vicinity of Trisakti wharf and Martapura wharf as shown in Figure 5-2 revealed that stratas of soft clay with "N" values of practically "O" extend down to approximately 30 meters from the existing ground level as shown in Figure 5-3. Compact sand layers appear from approximately 30 to 35 meters down from the existing ground level and highly

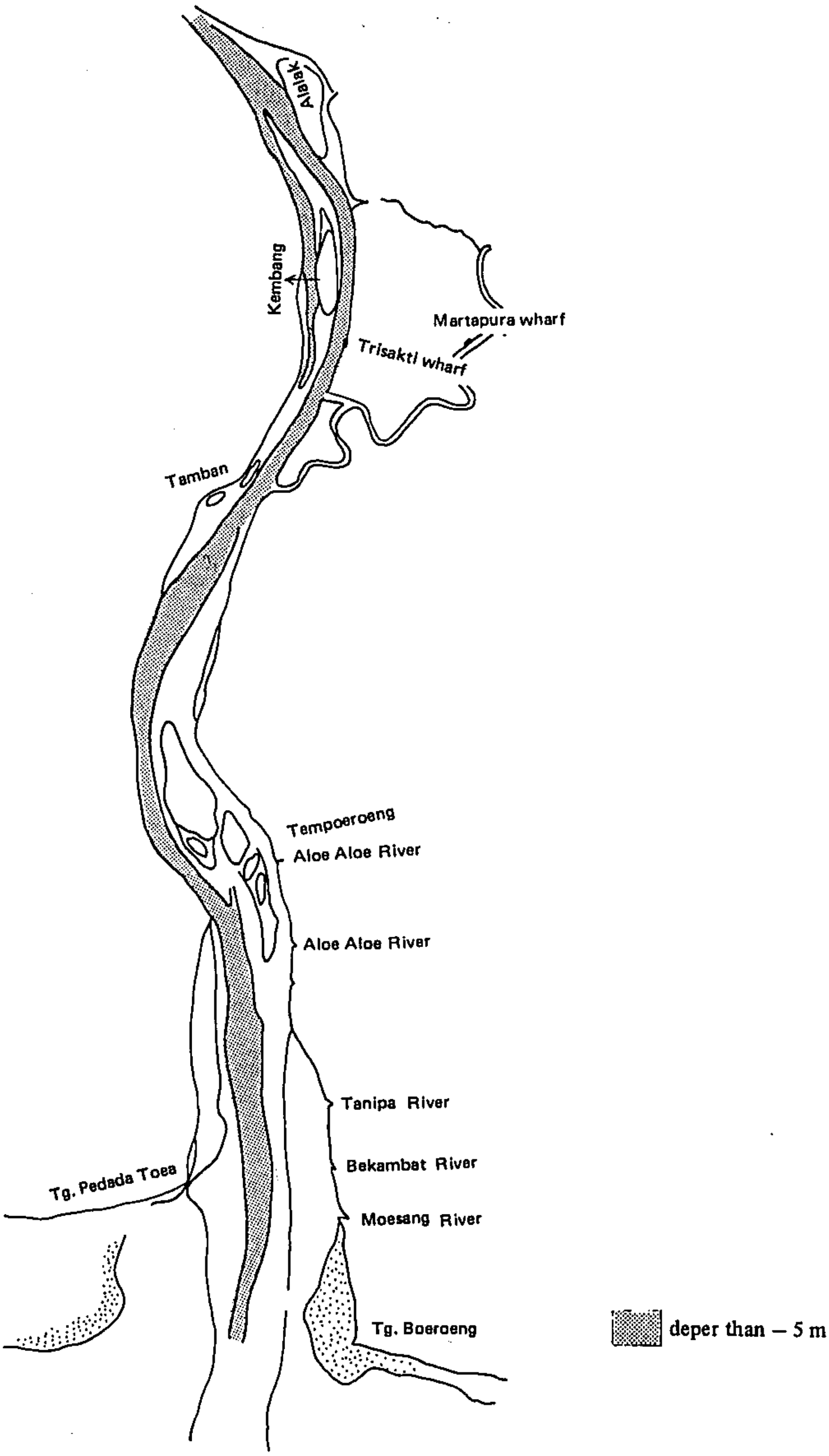


Fig. 5-1 Water Depth Distribution of Barito River

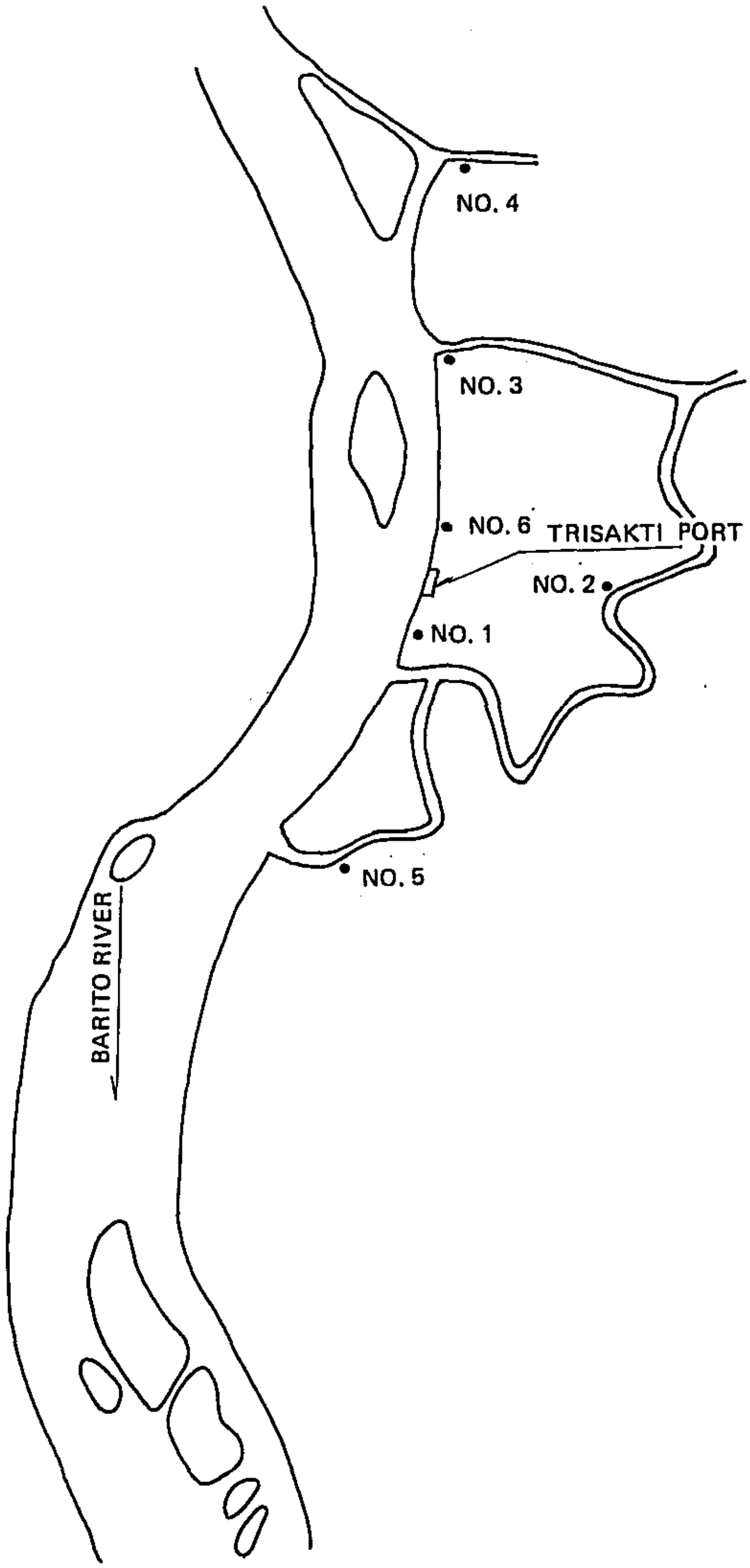


Fig. 5-2 Boring Position in Proposed Site of Banjarmasin Port

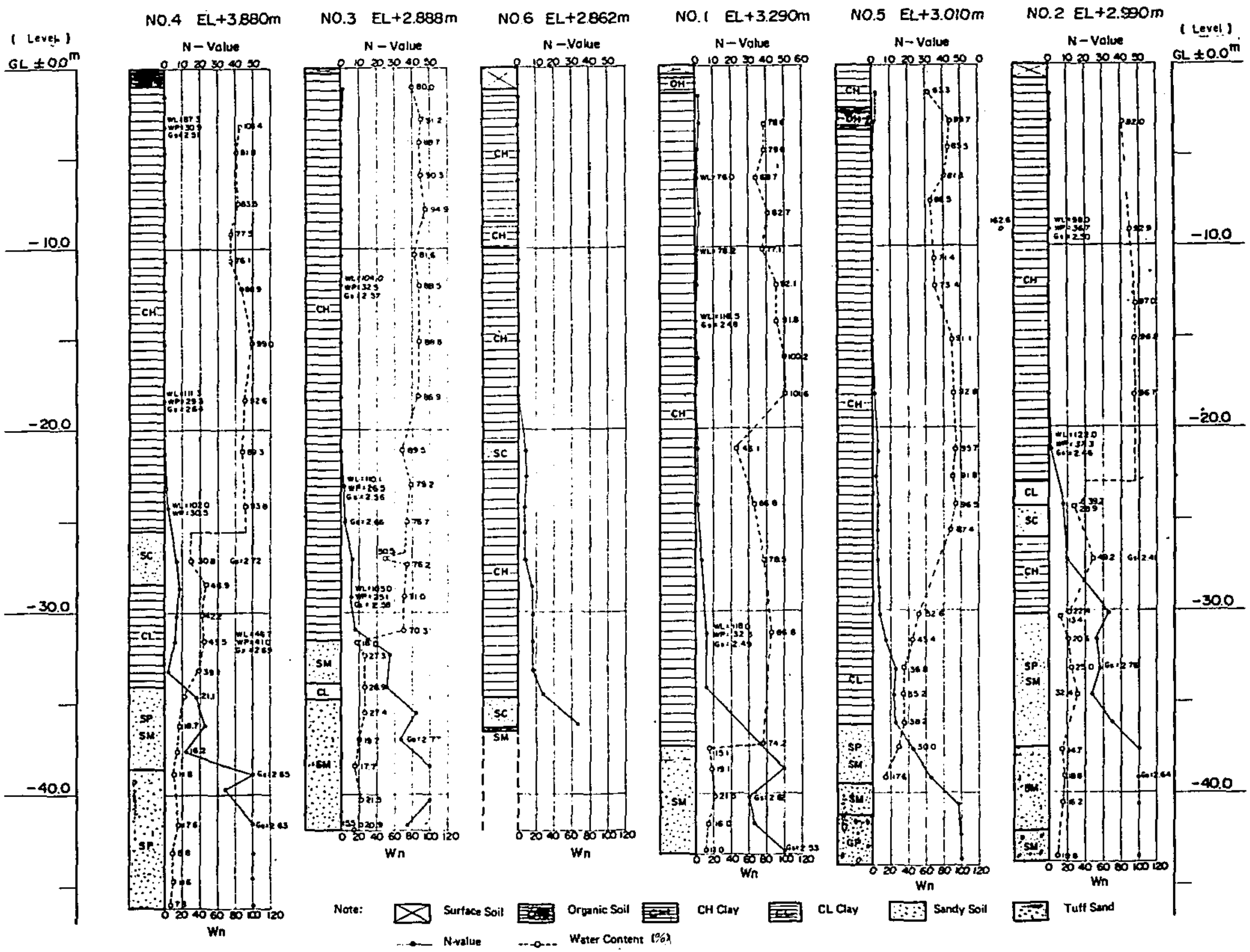


Fig. 5-3 Soil Profile of Proposed Site of Banjarmasin Port

satisfactory supporting strata with "N" values of 30 to 50 may be expected.

There is a slight difference in ground condition between Martapura Wharf and the banks of the Barito River.

Although the supporting strata appears at a slightly shallow depth near Martapura Wharf, as there is practically no difference in the other areas, it may not be possible to use land conditions as a key point in selecting a suitable port site.

5-3. Land Use Planning

5-3-1. Present Situation of Banjarmasin City

(1) Population

The change of population of late years in Banjarmansin city is as shown in the Table 5-2. The past few years do not show such a big increase in population as seen in the past. The population in the Service Area of Banjarmasin Port in 1971 was around two million, and 14% of the people are living in Banjarmasin city. The distribution of population in the Service Area of Banjarmasin Port is shown in the Table 5-3.

(2) Composition of Workers

The industrial composition of workers for the major industries in Banjarmasin city and the Service Area of Banjarmasin Port is as shown in the Table 5-4. In Banjarmasin city, the primary industry, including agriculture and forestry, forms 17% of the whole, while commerce and public service form 29% and 27% separately. This shows that the weight of the tertiary industry is increasing. Percentage of transportation and communication is 10%. Percentage of industry amounts to 10%.

However, judging from the Service Area, the weight of the primary industry, including agriculture and forestry, is great and forms 71% of the whole. The percentage of the total workers number in Banjarmasin city to that of the Service Area is 12%, and the weight of the primary industry is only 3% of the whole. From the above-mentioned, it is understood that Banjarmasin city is characterized as the center of economy, polities, information and traffic.

(3) Industry

The persent situation of the industry in Banjarmasin city is as shown in the Table 5-5 . Major factories are engaged in the sawing and plywood industries using wood as materials, and its percentage amounts to 24% of the whole factories, while the percentage of workers number reaches to 57%. As to the number of factories, the percentage for South Kalimantan in the Service Area is less than 70%. Supposing G.D.P. rate of the industries of Central Kalimantan and South Kalimantan are in the ratio of 2 to 8, the industrial ratio in Banjarmasin city is supposed to be more than 50% of the whole.

Table 5-2 Population and its Density in Banjarmasin City

Year	Population (x 1,000 persons)	Density of Population (person/ha)	Rate of Increase (%)	Converted in means yearly rate of increase (%)
1961	217	30.2	–	–
1966	287	39.9	32.3	5.8
1970	266	36.9	- 7.3	- 2.1
1971	281	39.0	5.6	5.6
1974	305	42.4	8.5	2.8
1975	312	43.4	2.3	2.3
1976	316	43.9	1.3	1.3

Source: City Planning Report, Banjarmasin City (Pemerintah Daerah Kotamadya Banjarmasin)
Kalimantan Selatan Dalam Angka 1975
Laporan Keraja (Progress Report) (Walikotamadya Kepala Daerah Tingkat II Banjarmasin Tahun Dimas 1975/76)
Population Census 1971 (South Kalimantan)

Table 5-3 Population in the Service Area of Banjarmasin Port

District	City	Population (x 1,000 persons)
South Kalimantan	Banjarmasin Others	282 1,272
Central Kalimantan	Palangka Raya Others	27 417
Total		1,997

Source; Population Census 1971 (South Kalimantan, Central Kalimantan Province)

Table 5-4 Percentage of the Industrial Composition of Workers

Kinds of Industry	Banjarmasin City (Workers number 83,000) (%)	Service Area (Workers number 676,000) (%)	Percentage of Banjarmasin City in Service Area (%)
Agriculture, Hunting, Forestry and Fishing	17.2	71.2	3.0
Mining and Quarrying	0.3	0.5	6.4
Manufacturing	10.1	3.5	35.8
Electricity, Gas and Water	0.3	0.1	40.9
Construction	3.0	1.0	37.7
Trade, Restaurants and Hotels	28.6	8.4	41.8
Transport, storage and Communication	9.9	2.1	57.8
Financing, Insurance, Real Estate and Business Service	0.8	0.1	79.1
Community, Social and Personal Services	26.9	9.6	34.5
Activities not adequately defined	3.0	3.5	10.6
Total	100.0	100.0	12.3

Source: Population census 1971 (South Kalimantan, Central Kalimantan Province)

Table 5-5 The Present Condition of Major Industry in Banjarmasin City

Types of Industry	Factories Number	Mean Output per Factory	Average Workers Number per Factory
Sawing	39	7,000 m^3	45
Plywood	2	150,000 lember	270
Crumb Rubber	4	3,000 t	130
Rotan	9	300 t	8
Dry Fish	6	400 t	13
Solid Salt	10	3,400 Pak.	20

Source: Laporan Keraja (Progress Report) (Walikotamadya Kepala Daerah Tingkat II Banjarmasin Tahun Dimas 1975/76)

(4) Traffic

Banjarmasin city plays an important part as a cardinal point in traffic both by sea and air, having a port with 10 m quaywall in the city, and an airport with 2,100 m runway in the suburbs.

Presently, inbound domestic trade of the consumption goods and daily living necessaries as well as outbound domestic trade and export of local products such as rubber and sawn timber in the service area depend on the Banjarmasin Port. The record shows that the amount of cargoes of 1,190,000 tons were handled in 1975.

On the other hand, Banjarmasin Airport is tied with Jakarta and Surabaya by a regular service, and is situated on the air route to Sulawesi, Ambon and East Kalimantan. It is also tied with Palangka Raya, Cotabaru, Balikpapan, Ujungpandung and Sampit by a local line.

As to the land route leading to the rear district of Banjarmasin city, an arterial road has been constructed to connect Banjarmasin city with Martapura and Tanjung. By this road a land transportation is maintained through Banjarbaru and Martapura. While Central Kalimantan district is connected with Banjarmasin city by ship instead of land route, since it is cut off by a large river like the Barito. The shipping in of consumption goods and daily living necessaries, as well as the shipment and export of local products such as rubber and log in the Service Area depend upon Banjarmasin Port. The time required and the distance in and around Banjarmasin city shall be estimated as listed in the Figure 5-4.

It takes about 30 minutes by car from Banjarmasin city to Banjarmasin Air Port, and about 45 minutes to Martapura. While as far as Kuala Kapuas in Central Kalimantan, it requires 2 hours and 30 minutes along the canal by speed boat. To Palangka Raya, capital of Central Kalimantan, it takes about 9 hours by using canal and river.

(5) Topographical Condition

The area in and around Banjarmasin city is composed of low wet land, and some part is left as in the state of waste land. From a distance of some 15 km east of Banjarmasin city, a hilly district appears. Since the greater part of Banjarmasin city is formed as in the state of wet land without banking, the most part of the urban area is flooded in the rainy season. This is due to the flood from Martapura river, which runs through the city, and other smaller rivers, with the influence of the water level and tide range of the Barito River.

(6) Utilization of Land

The present situation of utilizing land in Banjarmasin city is as stated in the Figure 5-5. The residential district is mostly extended along Martapura and Kwin rivers. Size of each house area is around 30 m^2 and mostly small in scale.

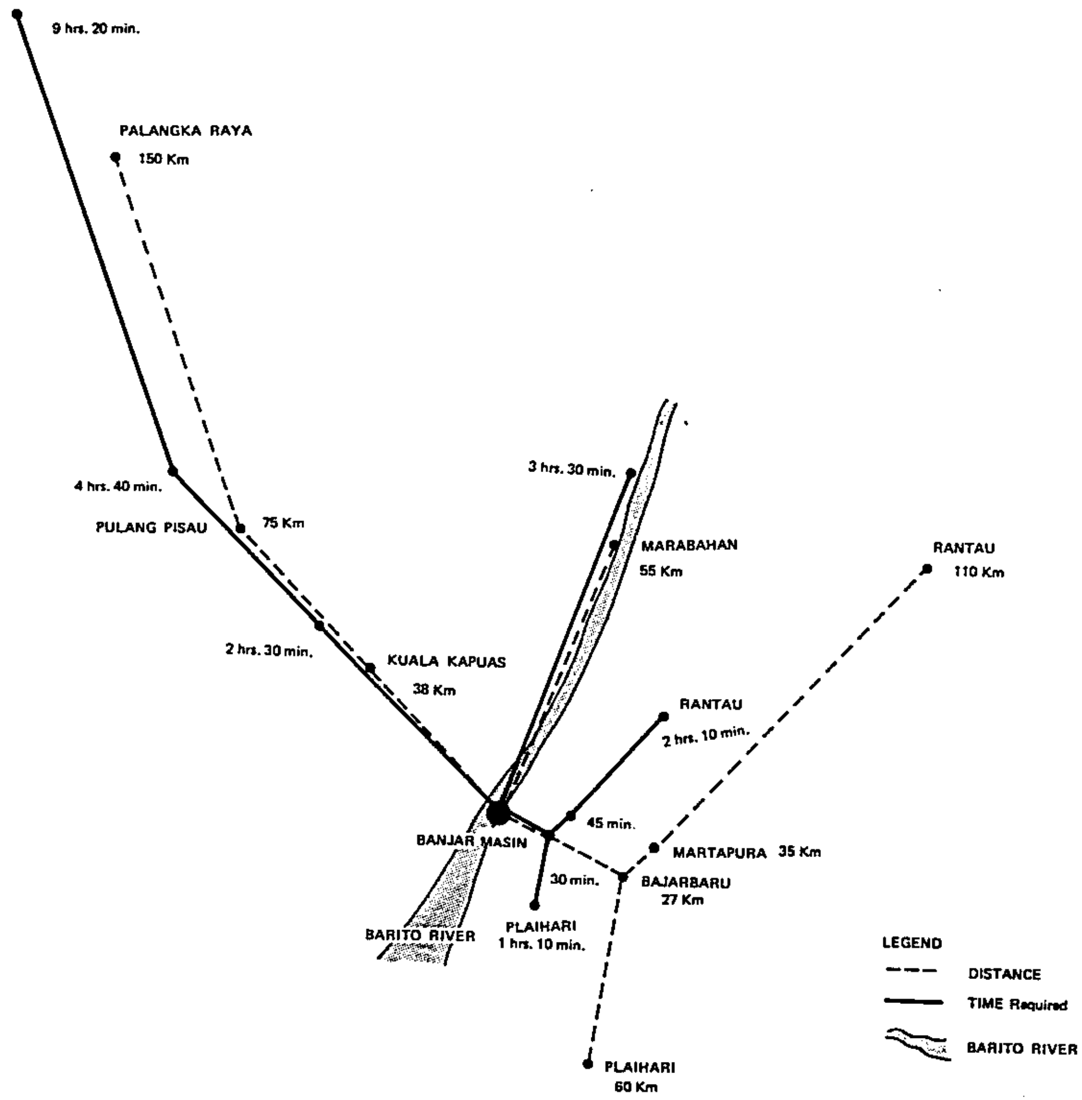


Fig. 5-4 The Time required and the Distance from Banjarmasin City

The central part of the city is located at the jointed portion of both traffic nets of land and river, forming active business section. As the means of transportation in the city, trucks, hand carts and others are used for goods, and beca, motorbikes, bicycles, cars, for men. Thus, various transport facilities are mixed together to make traffic congestion. This is also due to the condition that the streets are mostly two lanes roads. Major factories of sawing and plywood industry are situated along the Barito river. While some factories of sawing and rotan processing are located near Martapura wharf along the Martapura river.

Martapura wharf is located near to the central district of the city, and the port area contains some 4 ha. The environment of the port are composed of houses, shops, factories and warehouses, making a combined area.

Plywood, Sawingmills, Crumb Rubber factories are located around Trisakti wharf, but in the rear of the wharf, an area of some 300 ha is remained unused. Banjarmasin University is situated, with an area of 9 ha, in the western part of the urban area, though the city has no designated area for a school zone.

5-3-2. Urban Planning

Banjarmasin city can be valued as the future center of economic activity as it is the key point for labor and transportation. Import and shipping in of daily necessaries, food stuff and others, as well as export and shipment of products shall be carried out with Banjarmasin Port as center. Therefore, the economic growth of Banjarmasin city depends upon the development and expansion of the port.

It is essential to carry forward the development of Banjarmasin Port in a coordinated way with the entire development program of Banjarmasin city.

In consideration of the city planning of Banjarmasin city, the development frame which forms basis of the development plan of the Service Area, is supposed to be as mentioned below:

(1) Population

Population of Banjarmasin city in the future was estimated under the conditions mentioned below:

1) Increase of population in the Service Area is estimated to be 2.88% yearly on the average. The increasing rate in the outer Island of Pelita II shall be used.

2) In the increase of population of Banjarmasin city, the social increase shall be taken into account.

   In consideration of the increasing rate of the other cities in Indonesia and that of recent in Banjarmasin city, the increase of population with the social increase shall be estimated at some 4%.

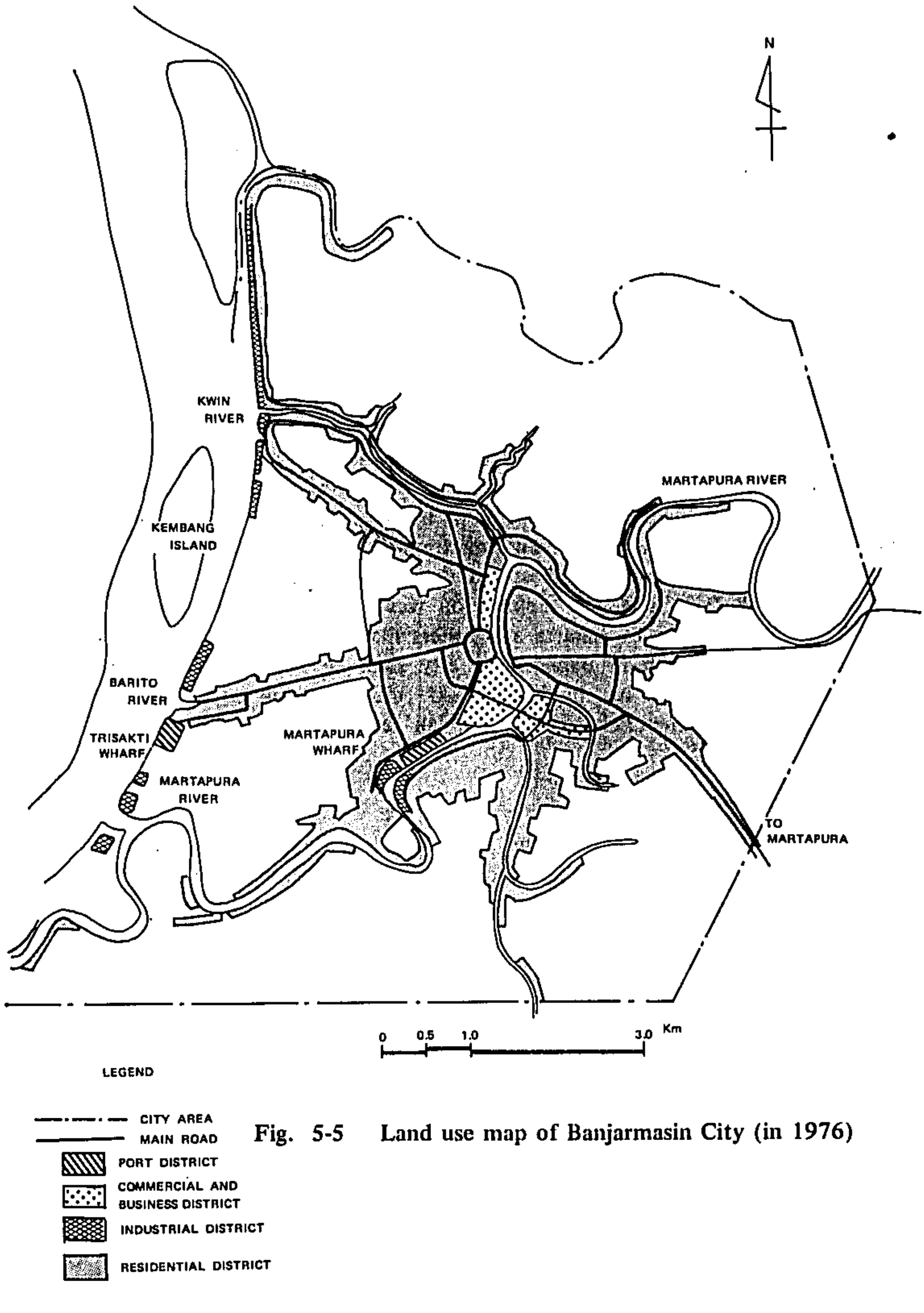


Fig. 5-5 Land use map of Banjarmasin City (in 1976)

3) In estimation of the future population, an increase of 3.5% shall be established, considering the intermediate value between average increase (mainly natural increase) and social increase.

4) Estimation shall be based on the population of 316,000 in 1976.

According to the above mention, the population of Banjarmasin city estimated to be 400,000 in 1983, and 730,000 in 2,000 A.D.

(2) Density of Population

In the study of the city planning, it is necessary to investigate the possiblity of expansion of the urban area in order to assume an ideal figure of the future city.

In Banjarmasin city of today, over 70% of the people live in a small scale house under 50 m^2. The Table 5-7 shows the proportion of houses classified by number of rooms. In Banjarmasin city, 38% of the people live in one room, and 75% in two rooms or under. The result of assumption for the scale proportion of house and site area, supposing the future improvement of the living environment, is mentioned in the Table 5-8 . However, the securing of the site area shall be considered as the first step to the improvement of living environment, and accordingly the house scale in the site may be enlarged corresponding to the rise of the standard of living. In setting up the site area, the assumption was made with reference to the planned scale for the suburbs of Jakarta and others made by D.P.U.T. Supposing the future density of population in Banjarmasin city shall be 100 persons/gross ha. in 1983, and 70 persons/gross ha. in 2,000, A.D. the following city planning was made. (D.P.U.T.; Departemen Pekerjaan Umum dan Tenaga Listrik)

(3) Scale of Site for Industrial Use

The increase of G.D.P. in the whole Service Area is estimated at 7.5% yearly. The estimation was made basing on the increasing percentage of the economic growth rate in Pelita II. When the future ratio of industrial production in the whole industries, is estimated setting a goal of some 16% increase, G.D.P. of industry shall be around 48 million U.S. dollars in 1983, and 325 million U.S. dollars in 2000 A.D. In 1973, G.D.P. of industry was 12 million U.S. dollars and the proportion of industry in the whole G.D.P. was some 4%. Supposing G.D.P. ratio to the shipment amount is around 30%, the future industrial shipment in the Service Area shall be as mentioned in the Table 5-9.

At present, nearly 70% of main industries in South Kalimantan are located in and around Banjarmasin city.

In the other hand, the scale ratio of industrial production of South Kalimantan in the Service Area is about 85% according to the estimation based on G.D.P. in 1972.

Table 5-6 Population of Banjarmasin City in the Future

Year	1976	1983	(1990)	2000
Population (x 1000 persons)	316	400	(510)	730

Table 5-7 Ratio of House Classified by Nmber of Room

(%)

Number of Room / District	1	2	3	4	5	6	7 -	Total
Banjarmasin	37.5	37.7	16.6	4.4	1.8	0.6	1.4	100.0
Surabaya	20.1	33.8	28.4	11.3	3.6	1.3	1.5	100.0
Medan	6.1	26.4	40.8	15.7	5.6	3.0	2.4	100.0

Source; Social Indicators 1974

Table 5-8 Estimation of Scale Proportion of Site Area and House Area in the Future

–	Site Area (m^2)	Average of house area (m^2)	Year (%)	
			1983	2000
Small scale	100	50	50.0	20.0
Middle scale	200	80	35.0	55.0
Large scale	300	150	15.0	25.0
Total	-	-	100.0	100.0

Table 5-9 Estimation of Industrial Snipping Amount in the Service Area of Banjarmasin Port

Year	1973	1983	2000
Industrial Shipping Amount (million US$)	40	160	1100

Note: Average 30% added Value is assumed
Shipping Amount is based on 1975 Price

The distribution of industrial production to the area in the future was presumed taking the followings into account.

1) The lumber industry of sawing and timber processing which use forest resources as raw materials shall be located by the riversides of the Barito and its tributary rivers in future also.

2) The primary processing factory of agricultural products such as rubber, palm and others shall be located on and around farms.

3) The consuming industry including foodstuff processing, furniture, and living necessaries has a strong inclination to be located in cities and towns, so the distribution was made in proportion to the population.

4) The processing industry which subject to export and shipment is thought to show a strong tendency to be located in and around Banjarmasin city from the transport condition.

Judging from the above-mentioned, it is considered that in 1983, factories correspond to some 50% of the shipment amount of the Service Area, and in 2000 A.D., factories correspond to some 30% of the shipment amount shall be located in and around Banjarmasin city. Factory site and workers number needed to this scale are as estimated in the Table 5-10.

(4) Traffic Volume

At present, only one main road runs to the hilly district in the east, including Martapura and Banjarbaru, from Banjarmasin city. This existing road is the 3rd class national road having 2 lanes and weight limit of 2 tons. Average traffic volume per day is recorded as follows; 600 trucks, 1,200 passenger cars, 10,000 motorcycles, and 300 other vehicles, totaling 12,000 vehicles in all.

This road leads to Trisakti wharf through the central part of Banjarmasin city. In the center of Banjarmasin city, there is only one bridge on which vehicles can go through. Main streets in Banjarmasin city are partly arranged with 4 lanes but mostly with 2 lanes. Narrow roads in the residential district are 1 - 2 lanes.

1) Estimation of traffic volume arising from the Port and factories in the vicinity.

Estimation of traffic volume arising from Port and factories in the vicinity are made, making the following goods an object of the estimation.

a) Sending in materials to factories in the vicinity of Port.
b) Transportation of factory products for export and shipment to the Port are from the factories located in the Service Area.
c) Carrying out of the goods produced by factories in the vicinity of the Port in the amount demanded in the Service Area.

Table 5-10 Land for Industrial Use around the Banjarmasin Port

	Year	1983				2000 A.D.				Remakrs	Site Area for Industrial Use including Green Zone and Road (ha)	
	Types of Industries	Production Scale (x 1000 t)	Shipping Amount (million US$)	Site Area (ha)	Workers Number (x 1000 persons)	Production Scale (x 1000 t)	Shipping Amount (million US$)	Site Area (ha)	Workers Number (x 1000 persons)		1983	2000 A.D.
Industries to be an Object of export or Shipment	Lumber Processing	405	58	105	11	840	143	165	18	Sawing, plywood Furniture, Paper		
	Rubber Processing	20	.8	10	1	53	70	35	5	Crumb Rubber Tire		
	Livestock, Fish Processing	-	-	-	-	19	10	10	1			
	Agricultural Products Processing	-	-	-	-	289	79	75	8	Including Palm Oil		
	Others	10	3	5	1	8	3	5	1	Other hand Industries	180	410
Industries to be an Object of import or Shipping in	Cement and Secondary Products	-	-	-	-	187	13	15	1			
	Assembling and Repairing of Machinery	8	4	5	1	56	28	15	5	Repair of Agricultural Machinery		
	Others	-	13	45	4	-	21	70	6		70	140
	Sub-Total	-	82	170	18	-	367	390	45			
	Green Zone/Road	-	-	80	-	-	-	160	-		(80)	(160)
	Total	-	82	250	18	-	367	550	45		250	550

Note: Shipping amount is based on 1975 price

d) Distribution of goods shipped in or imported in the Service Area.

Production goods out of commodities to be shipped in or imported shall be distributed according to the areas of farming or farms, and the traffic volume shall be estimated accordingly. It is considered that the living necessaries shall be distributed corresponding to the distribution of population. Traffic by rivers is considered as the main means of transportation to Central Kalimantan and a part of South Kalimantan (around Barito River).

The quantity of goods which will form basis of estimation for the future traffic volume in the vicinity of the Port shall be estimated by the way shown in the Table 5-11.

Transportation to Central Kalimantan and a part of South Kalimantan shall be made by using canal and river. Transportation to the Hilly district of south Kalimantan from Banjarmasin Port shall be made by land carriage.

2) Estimation of traffic volume arising in connection with the road plan shall be made on the following views as a basis.

a) Average loading capacity per truck shall be 5 tons for bulk goods, and 1 ton for sundry goods.
b) Acting loading ratio of trucks shall be 50%.
c) Mixing ratio of trucks shall be 20%.
d) Ratio at the peak hour shall 15%.

Estimation of traffic volume based on the quantity of goods mentioned above shall be as shown in the Table 5-12.

Estimation of traffic volume at the peak hour, basing on the number of truck mentioned above, shall be approximately 2,900 cars/hour.

Estimation of traffic volume in 2000 A.D. was made in the same way of thinking for in 1983.

However, mixing ratio of traffic volume of trucks is estimated at some 40%, supposing future necessity of a by-pass road.

Estimation of quantity of goods in the vicinity of the port shall be as mentioned in the Table 5-13. And estimation of traffic volume expected in future shall be as shown in the Table 5-14.

Estimation of traffic volume at the peak hour, basing on the number of trucks mentioned in the Table 5-14, shall be around 5,600 cars/hour.

(5) Road Planning

Entry of local vessels and sailing vessels to Martapura wharf is scheduled during the period before 1983. In case to make plan to build a bridge to relieve the traffic

Table 5-11 Estimation of Goods Volume Arising in and around the Banjarmasin Port Area in 1983

(x 1000 tons)

	Sort of Goods	Origin of Goods					Distribution Area of Goods						Remarks
		Central Kalimantan	South Kalimantan (Plain Zone)	Banjarmasin City	South Kalimantan (Hilly District)	Total	Central Kalimantan	South Kalimantan (Plain Zone)	Factory around the port	Banjarmasin City	South Kalimantan (Hilly District)	Total	
Sending in of Raw Materials	-	11	-	-	19	30	-	-	30	-	-	30	
Products to be an object of Export or Shipment	Bulk	3	1	-	6	10	-	-	-	-	-	-	Send in to Port Area
	Sundry	66	3	-	101	170	-	-	-	-	-	-	
Distribution of Factory Products in the Area	Bulk	80	-	-	-	80	-	-	-	-	80	80	Distribution from Factories around the Port Area
	Sundry	-	-	5	-	5	1	1	-	1	2	5	
Distribution of Goods imported or shipped in	Bulk	-	-	-	-	-	20	8	-	-	48	76	Send out from the Port Area
	Bulk (Buoy)	-	-	-	-	-	45	26	90	29	100	290	
	Sundry	-	-	-	-	-	104	60	3	65	232	464	

Note: Sending in of material Wood, 368,000 tons, to lumber Processing factory is not included in the Table

Table 5-12 Estimation of Traffic Volume in the Future (Land Transport 1983)

Sort of Goods	Goods Volume (1000 ton/year)	Number of Trucks per day (truck/day)
Bulk Goods	263	188
Sundry Goods	420	1,500
Total	-	1,688

Table 5-13 Estimation of Goods Volume Arising in and around the Banjarmasin Port Area in 2000 A.D.

(x 1000 ton)

	Sort of Goods	Origin of Goods					Distribution Area of Goods						Remarks
		Central Kalimantan	South Kalimantan (Plain Zone)	Banjarmasin City	South Kalimantan (Hilly District)	Total	Central Kalimantan	South Kalimantan (Plain Zone)	Factory around the port	Banjarmasin City	South Kalimantan (Hilly District)	Total	
Sending in of Raw materials	-	102	11	-	189	302	-	-	302	-	-	302	
Products to be an object of Export or Shipment	Bulk	254	68	-	552	874	-	-	-	-	-	-	Send in to Port Area
	Sundry	252	25	-	401	678	-	-	-	-	-	-	
Distribution of Factory Products in the Area	Bulk	220	-	18	-	238	4	2	-	3	229	238	Distribution from Factories around the Port Area
	Sundry	-	-	38	-	38	9	4	-	6	19	38	
Distribution of Goods imported or shipped in	Bulk	-	-	-	-	-	119	49	100	16	282	566	Send out from the Port Area
	Bulk (Buoy)	-	-	-	-	-	225	111	500	162	502	1500	
	Sundry	-	-	-	-	-	318	152	-	184	720	1374	

Note: Sending in of material wood, 770,000 tons, to lumber processing factory is not included in the Table.

Table 5-14 Estimation of Traffic Volume in the Future (Land Transport in 2000 A.D.)

Sort of Goods	Goods Volume (1000 tons/year)	Number of Trucks per day (truck/day)
Bulk Goods	1,565	1,118
Sundry Goods	1,329	4,746
Total	-	5,864

congestion in the city and to meet the need of transportation of goods in and around Port area during the period, the building site shall be limited. Judging from the present geographical condition of the urban district, it, for the time being, cannot be avoided to permit traffics through the cener of the city. However, existing bridges in the city are in a bad condition and only one bridge of all is capable to allow the passage of vehicles, so it is urgently needed to improve the present condition. It is also needed to plan to build several new bridges in addition to the existing ones and to consider to relieve traffic congestion in the city.

1) On the other hand, traffic volume arising in and around the port area shall be some 2,900 cars/hour at the peak hour in 1983. Possible traffic capacity shall be some 2,100 cars/hour on 2 lane road and some 4,200 cars/hour on 4 lane road. These values were obtained by the estimation made under the following conditions.

a) Situation around the road shall be urbanized.
b) Mixing ratio of trucks shall be fixed at 20%.
c) Place with a signal shall be existed on the road,

When we think of the required number of new routes to be constructed, basing on the present condition of the city and the future demand of traffic, we find it necessary to schedule to make 2 routes or more, each in two lanes, running from the Port area to the Hilly district of South Kalimantan through the urban district.

2) On the other hand, in 2000 A.D., the function of Martapura Wharf shall be moved to the riverside of the Barito and the number of berth shall be increased. Quantity of goods arising in and around the Port area shall be about 10,000 tons/day, and traffic volume shall be some 5,600 cars/hour. On this occasion, transport of the goods to the Hilly district of South Kalimantan through the urban area, should be avoided in consideration of the improvement of city environment and increase of the traffic volume. It is required to make a new by-pass road.

Varying from the occasion in 1983, conditions around the by-pass road in 2000 A.D. shall be presumed as follows and road capacity shall be estimated accordingly.

a) Urbanization around the road will comparatively slow.
b) Mixing ratio of trucks shall be fixed at 40%.
c) Intersections with a signal shall be reduced as practicably as possible.

The possible traffic capacity, under these conditions, shall be extimated at some 3,000 cars/hour on 2 lane road and some 6,100 cars/hour on 4 lane road. Consequently, at least a by-pass road with 4 lanes and some 30 m width shall be needed in 2000 A.D. Designed section of the road is mentioned in Figure 5-6.

(6) Viewpoint of Land Utilization

The viewpoint of the land utilization plan classified by main use, which include sites for factory, Port and residence, is as follows:

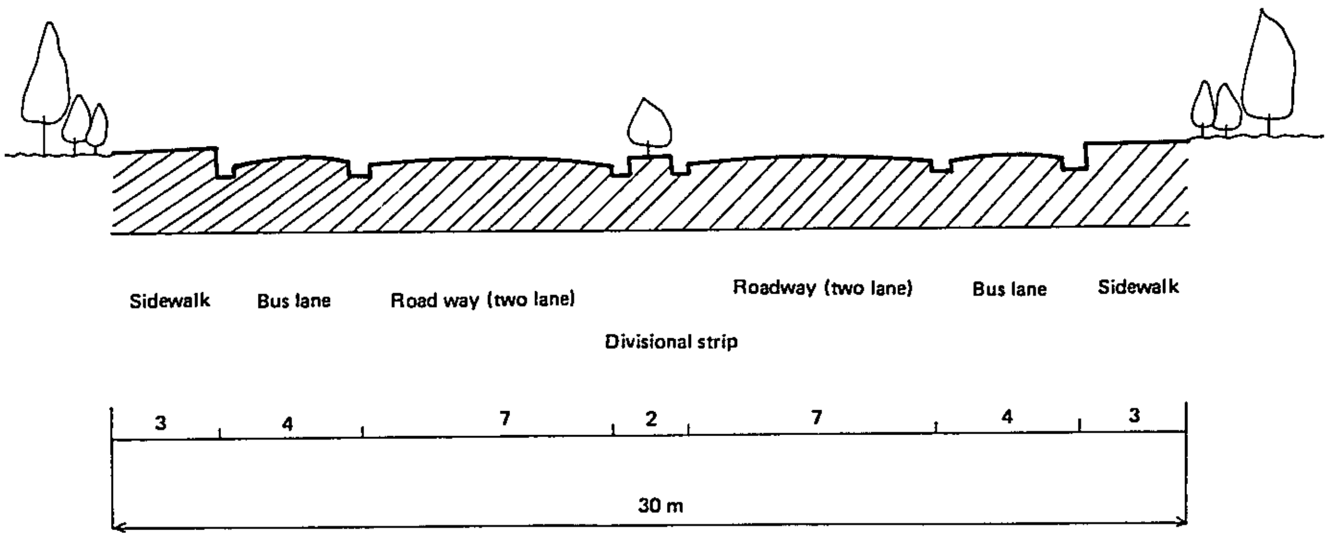


Fig. 5-6 Section of Bypass Road

1) Factory Site

Key industries in and around Banjarmasin city are timber processing industry including sawing and plywood manufacturing, rubber processing industry, palm oil manufacturing industry, and cement and its secondary products manufacturing industry.

Special character of the location of each industry shall be arranged as shown in the Table 5-15. As for the timber processing industry, except the furniture manufacturing industry, material wood are brought in through the Barito river, therefore the riverside location of the Barito river becomes essential. Along the by-pass road, that is the area, around the road leading to the Hilly district of South Kalimantan, can be considered as locations for cement manufacturing industry, repairing works of tractor and agricultural machinery, furnitire manufacturing industry and rubber processing industry. While the processing factory of estate products shall be located around the estate to perform the primary processing, and in this way the factory will develope the capacity to bear freight charges and strive to rationalize the transportation by condensing the volume.

From local conditions, it is necessary to select the location of residential district for the workers in the neighbouring area of the factory site so that the commutation distance may be shortened.

2) Port Site

Port site shall be prepared mainly along the downstream riverside of the Barito river with Trisakti wharf as the center. The further enlargement of the Port shall be required to correspond with the development of economic in the future. Therefore, it is essential to reserve the land for future enlargement around the present site of Port, standing on a considerable long-range prospect. To keep a part of this land as green zone is a good plan. Port site and factory site shall be linked with a industrial road, and it is better not to allow the traffics through the urban area.

Relation between the port and the urban district is considered as follows:

a) Laying out of green belt and park shall be planed, leaving a part of riverside line, so that people in the city will be able to touch with the Port and the Barito river to enjoy it in their lives.
b) Commutation route leading to the residential district of the Port workers and the staff of the Government office which control the Port works shall be secured.
c) Residential district shall be connected with the center and the business section of the urban area so that people will be able to reach there easily.

3) Residential Area

Residential area is scheduled in blocks of 50,000 population, following the

Table 5-15 Special Character of Location of Industry

Types of Industries	Conditions of Location							
	Sending in of Raw Materials			Sending out of Products			Need of Road to the Rear District	Need of Apprach to Consuming District
	River	Road	Port	River	Road	Port		
Lumber Processing Sawing, plywood	○			△	△	○		
Furniture manufacture		○		△	○	△	○	○
Paper manufacture	○			△	△	○		
Rubber Processing	△	○				○	○	
Livestock, meat and skin processing	△	○			△	○		
Fish Processing	○				△	○	○	△
Agricultural Products Processing	△	○		△	△	○		△
Cement		○		△	○		○	
Cement Secondary Products		○	△	△	○		○	○
Assembling Repair of Machinery		○	△		○		○	○

Note: Mark ○ shows main percentage
Mark △ shows a need partially
Markless shows unnecesary or a least need

examples of the advanced nations and the housing program of D.P.U.T. for the outskirts of Jakarta. Assuming from the fixed density of population, that is 70 persons/gross ha. in the entire urban area, the block, in size, shall be equal to the round area haveing a diameter of some 2 km.

While, when it is considered with the central zone of the block as center, it shall be almost equal to the living area, and distance to anywhere in the area shall be some 1 km. within an easy walking.

Business facilities, administration service facilities and service industry shall be established in the central area.

5-3-3. The Basis of Land Use Control

(1) Relations with the surrounding area of Banjarmasin City

The Banjarmasin City and the eastern hilly district with the towns of Banjarbaru and Martapura as the center are located very closely with each other in a distance of travel less than one hour, and they will develop with the functions of living and production complementing each other. It is believed that, characteristically, Banjarbaru with its current local government offices possesses the possibility of developing into a city of administrative bureaus, schools and military units. Along with advancements in the development of farms and agricultural and in the vicinity, the towns of Banjarbaru and Martapura should develop as satellite cities.

(2) The Axis in the Development of Banjarmasin City

It is believed that the city of Banjarmasin had developed around the following two axis. One of these is the Martapura river flowing through the center of the city and the other is the Soetoyo street and National road passing through the center of the city from Trisakti wharf and extending in the direction of Martapura.

Considering the fact that this area will join the hilly district to the east in the future and that river transportation will play the principal role in future in the vicinity of Banjarmasin city, or that the functions of the city already accumulated cannot be completely ignored, it is believed that the city of Banjarmasin will continue to develop around these 2 axis.

When planning the future figure of the city, the location of the city center becomes and important factor. Not only will it be inadvisable to completely ignore the accumulated functions of the city of Banjarmasin with its current population of 280,000. In fact, it is considered advisable to accept and utilize these functions as long as they do not obstruct the future growth of the city.

The optimum method is therefore to develop the city centered on the area currently occupied by the principal government and municipal offices, banks etc. that play the central role in the city; together with some land readjustments. A recreation area complete with a green park of suitable size where the people would be able to enjoy a view of the port and the Barito river is planned upstream from the Trisakti wharf.

At the rear of the Trisakti wharf there is currently a swamp area, or more aptly, a virgin plain of 300 to 400 hectares. Housing construction will be restricted and residential areas avoided in this area to reserve this area for future port expansion.

For environmental improvement, an area of approximately 100 meters in width will initially be prepared as a green buffer zone. On one hand, a commercial district is planned in the back of the port area for the future port workers and crew members of the ships utilizing this port. However, it will be necessary to locate this site in a suitable area to avoid spreading out the facilities excessively.

Further, although a portion of the banks of the Martapura river near the city center has already been converted into a park, it will be necessary to further expand this area. It will be desirable in future to further improve and expand the area along the Martapura river centered on the current commercial district. This is based on the consideration that high dependance on river transportation will remain in future in the vicinity of Banjarmasin city and that importance will continue to be placed on river transportation of perishables, etc.

One other reason is the easy accessability from the suburban area to the present Commercial section.

(3) Future expansion of the suburbs of Banjarmasin city

Taking into consideration the conditions of the surrounding terrain and the current layout of the city, it is believed that the following method of approach would be suitable in planning the traffic network in Banjarmasin city.

1) In planning the city, the network of streets shall be laid out in such a manner as to avoid obstructing city functions and shall be in relation to the estimated population for the years of 1983 and 2000 A.D. respectively.

2) The basic structure of the network shall be a combination of radial streets and loopstreets with its center near the current city center.

3) The residential area planned between the principal radial streets and loopstreets shall be approximately 100 ha in basic area.

4) A residential block will consist of 4 residential areas and thus be approximately 400 ha in size.

5) The commercial district within the block shall be within walking distance or approximately 1 km from the furthest point.

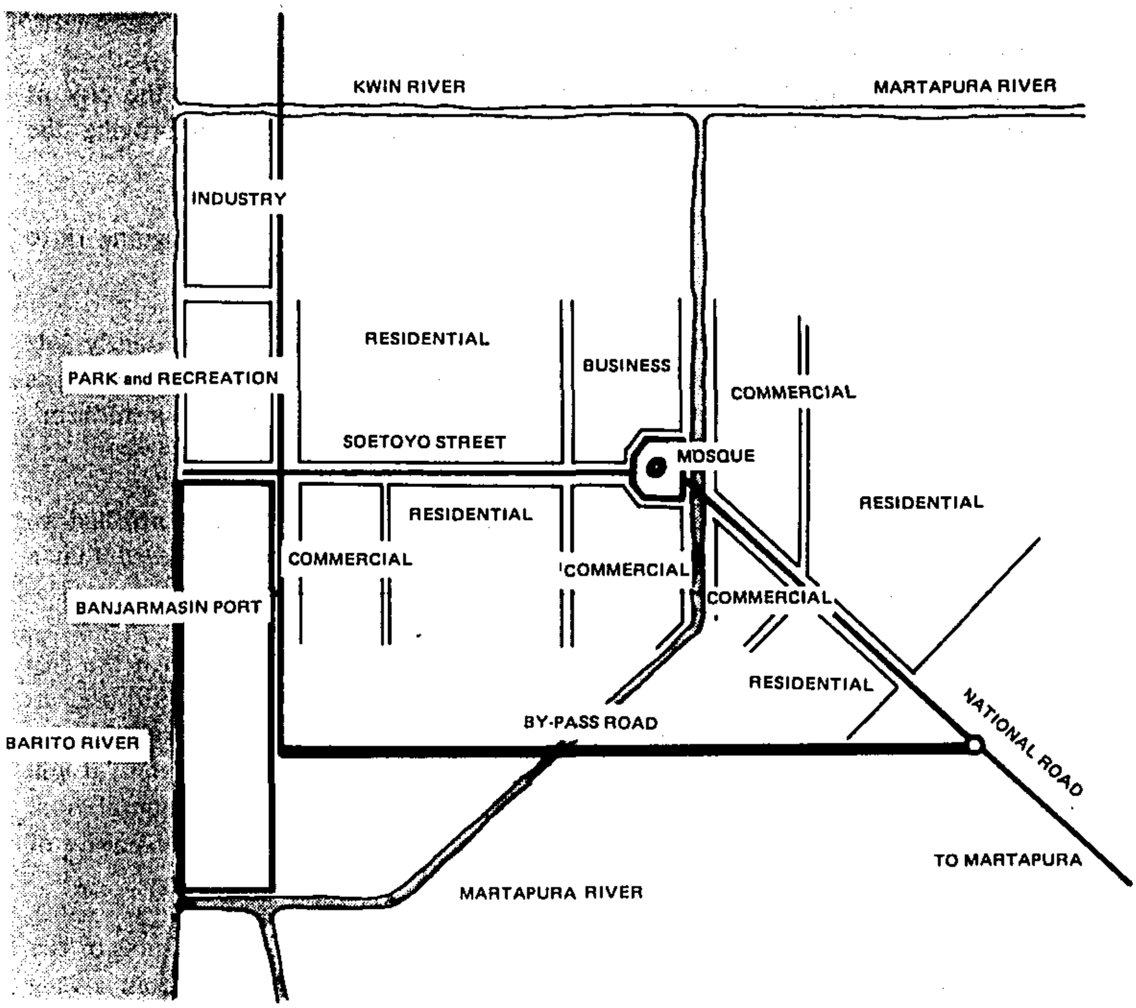


Fig. 5-7 The Axis in the development of Banjarmasin City

6) The roads leading from the port area will consist to the existing road and a road for combination city traffic, and also a highway by-passing the city.

7) The planned road network in 1983 will be included in the plan for the year 2000 A.D. and completion will be targeted for that year.

8) The new residential districts planned for the year 2000 A.D. and the city of Banjarmasin will be connected by means of extending and improving the existing roads.

Figure 5-8 shows the road network planned taking the foregoing into consideration.

Also, the low swamp area of approximately 300 ha which is presently left untouched at the rear of the port area must be reserved for future port functions and respond immediately to technical and transportation revolutions. In addition, this area must be controlled as a restricted section for residential districts.

Expansion of the urban area for the year 2000 A.D. will be controlled to expand centripetally around the present city center. It is however believed that a portion of this expansion will extend eastward along the national road.

It will be necessary to prevent the transportation of port cargo through the city wherever possible. Although the bypass road is required for this purpose, as investments will be high and as some time will be required prior to opening for common use with the principal local roads with which it will be connected, it will be necessary to utilize the existing roads as a temporary measure until completion. The following items must be taken into consideration when planning the course of the bypass road.

1) The road must be planned at points coordinating with future expansion of the urban area. In other words, the scope of urban district planning from a long range viewpoint should not be considered and the route should be set set along the outer side.

2) When planning the bypass road, stress will be placed constructing the road in a straight line or with easy curves with level crossings basically being avoided rather than a road for high speed transportation of cargo outside the area.

3) Construction cost will be held to a minimum by selecting a course requiring the least number of bridges.

4) The plans will incorporate a 2-way 4-lane highway with a median strip with the outer lanes reserved for public transportation such as buses etc. and side walks will be provided along the outer edge.

Estimation of the traffic volume for the bypass road and its cross section are shown in Table 5-14 and Figure 5-6.

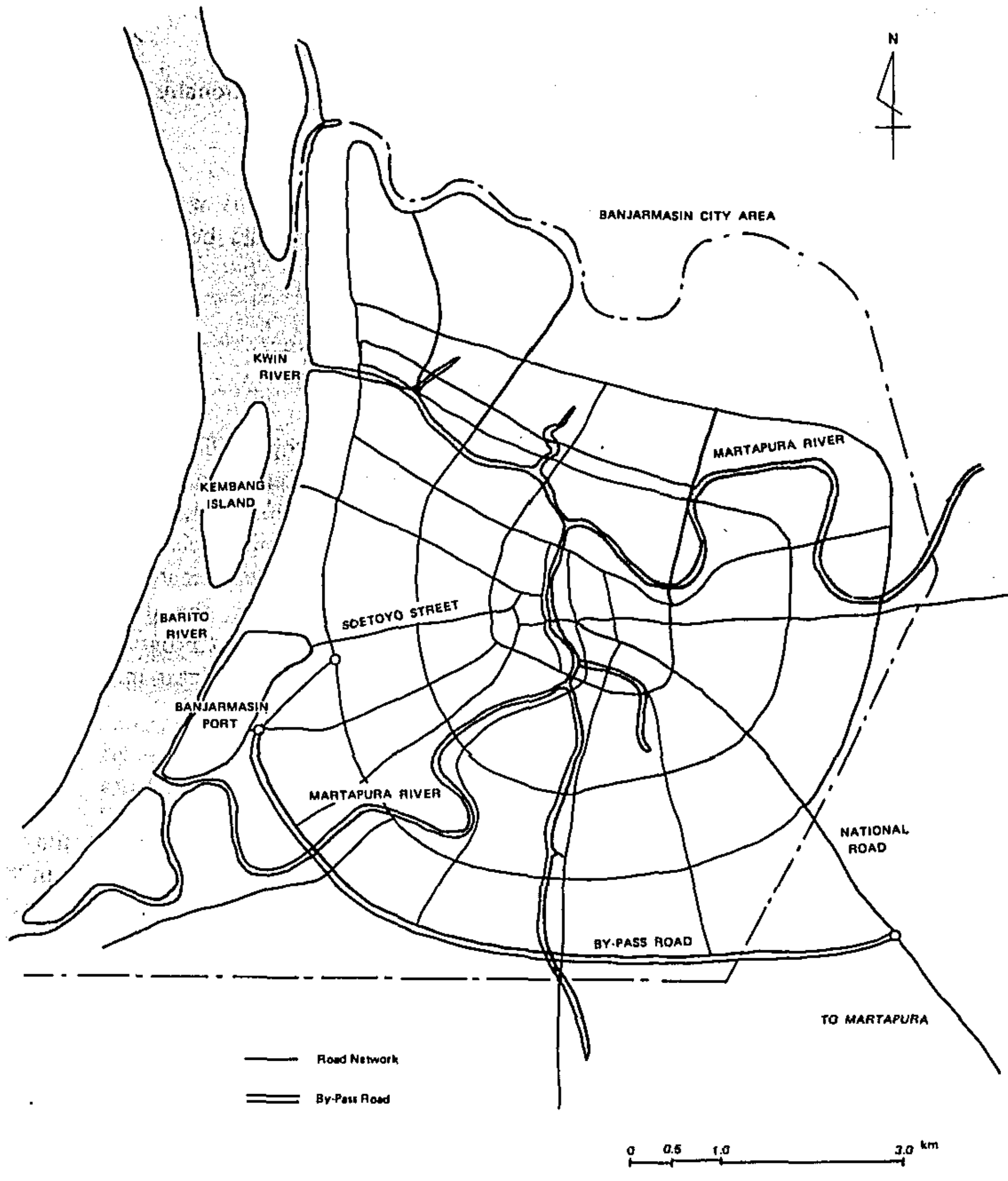


Fig. 5-8 The Future Plan of Road Network

Considering the usage condition of Martapura wharf in 1983, it will be possible to cope with the increased volume of cargo by incorporating plans such as the following.

1) Bridges allowing passage of vehicles should be built additionally in the central zone of the city.

2) For connection of the Banjarmasin City and its environs with the port, the Soetoyo street should be improved, while another road should be constructed. The latter road should also serve as an urban street.

(4) Redevelopment of the area around Martapura Wharf

A commercial district of approximately 200 ha in scope will be required at the center of Banjarmasin City to cope with the estimated population of 730,000 in the year 2000 A.D. For this reason, it will be necessary to gradually transfer the present functions of Martapura Wharf, which currently adjoins to commercial district, to the riverside of Barito River from 1983. It will then be desirable to readjust the vacant area and redevelop it as a special commercial district for the distribution of perishable food supplies and daily supplies. In this redevelopment program, it will be necessary to incorporate modern markets, shopping centers and plazas in the vicinity of Martapura Wharf.

(5) Banjarmasin City Land Use Plan

The percentage of land usage by application in 1983 and 2000 A.D. may be estimated to be as shown in Table 5-16. Actual examples of city planning in the advanced nations and an average proportion of Japanese cities with similar characteristics were used as references in preparing this estimation.

If the conception of future land usage in Banjarmasin City were shown in graphic form, they would appear as in Figures 5-9 and 5-10.

Table 5-16 Percentage of Land Area Usage by Application in the Future

Land Use	1983		2000 A.D. Year	
	Area (ha)	Percentage (%)	Area (ha)	Percentage (%)
Residential	1800	50	3060	50
Commercial	140	4	210	3.5
Business	140	4	210	3.5
Industrial	250	7	550	9
Port	110	3	180	3
Roads/Rivers	580	16	920	15
Green Area	580	16	980	16
Total urban area	3600	100	6110	100
Others	3600	-	1090	-
Total	7200	-	7200	-

Note: Areas reserved for development and farm land are included in the "others"

In 1983 Population .... Approximately 400,000 persons
Population density will be 100 per ha with 90% of the population in the urban area

In 2000 A.D. Population .... Approximately 700,000 persons
Population density will be 70 per ha with 70% of the population in the urban area
Residential area capable of coping with 30% of the population (approximately 200,000 persons) is planned for construction in the east of the present city area along the national road.

Table 5-17 Population by District in the Future

(x 1000 persons)

District	1983	Year 2000 A.D.
Urban Area	400	500
New Residential Area	-	230
Total	400	730

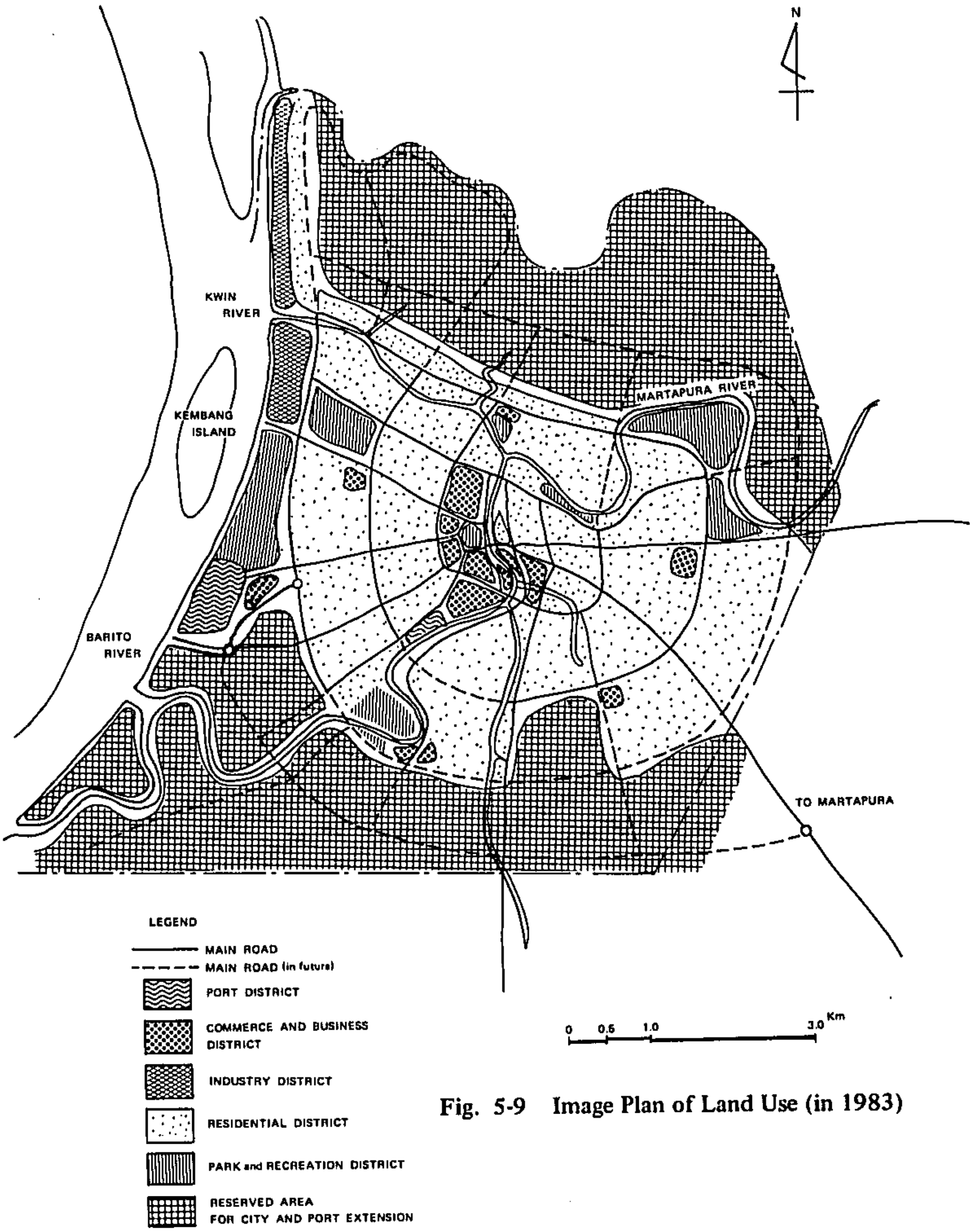


Fig. 5-9 Image Plan of Land Use (in 1983)

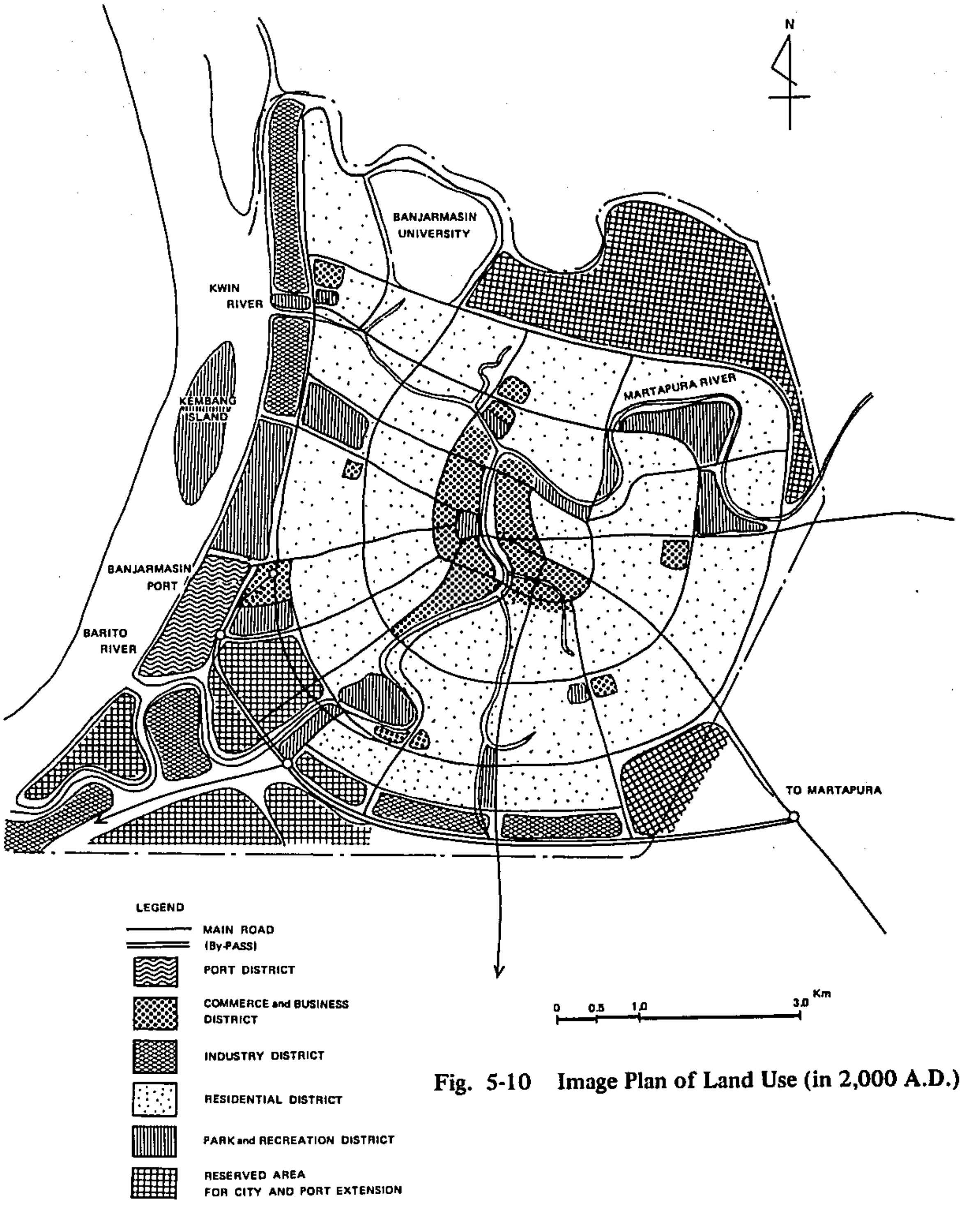


Fig. 5-10 Image Plan of Land Use (in 2,000 A.D.)

5-4. General Arrangement of Port Facilities

5-4-1. From the viewpoint of vessel approach from Barito River, effective usage of the water line and the coordinated relations between the industrial area and the port etc., as explained in Paragraph 5-2, the area sandwiched between Barito River and Martapura River, which has shown practically no signs of development, was selected for usage as the port terminal area. This area extends to Teluk Dalam/Soetoyo street on the north and, excluding the Martapura Wharf area which encompasses some of the residential districts of Banjarmasin city, has an area of approximately 500 hectares. On one hand, as the volume of cargo handled by the wharf in the year 2000 A.D. will approach approximately 3,740,000 tons as explained in Paragraph 5-1, and as the required port terminal area to cope with this volume is estimated to be about 130 hectares, there will be considerable room for selection of port terminal site.

Here we have listed the elements considered as conditions for the port site selected as follows:

(1) Ocean going and large size vessels to be capable of mooring along the Barito River.

(2) Interinsular vessels, local vessels, sailing vessels and other small and medium size vessels to be capable of mooring along the banks of the Martapura River as much as possible, however, where the water line is insufficient, the bank of the river to be dredged to establish the artificial basin for mooring. But such dredging should be kept in a minimum scale.

(3) Mooring facilities for local vessels and sailing vessels to be located for convenient access to the center of Banjarmasin city.

(4) During each stage of facility improvement between 1978 and the year 2000 A.D. layout of the facilities must be considered to permit continued efficient coordination between the various facilities.

(5) Activities between the industrial area and the port to be coordinated.

(6) Sufficient leeway for development to be considered during changes in plans up to the year 2000 A.D. and to subsequent developments.

From the above viewpoint, three alternatives are marked Plan-A, Plan-B, Plan C, proposed for the selection of the port and harbor terminal as shown in Fig. 5-11 in the Interim Report, and the IndonesianGovernment chose the alternative Plan-B in which the dredging mud quantity is at the minimum, mainly from the standpoint of saving the expenses required for the dredging work.

Based on the alternative Plan-B and after giving discussions to the alternative Plan-B in order to further save the dredging expenses, the final report in draft was prepared (See Fig. 5-12, 5-13).

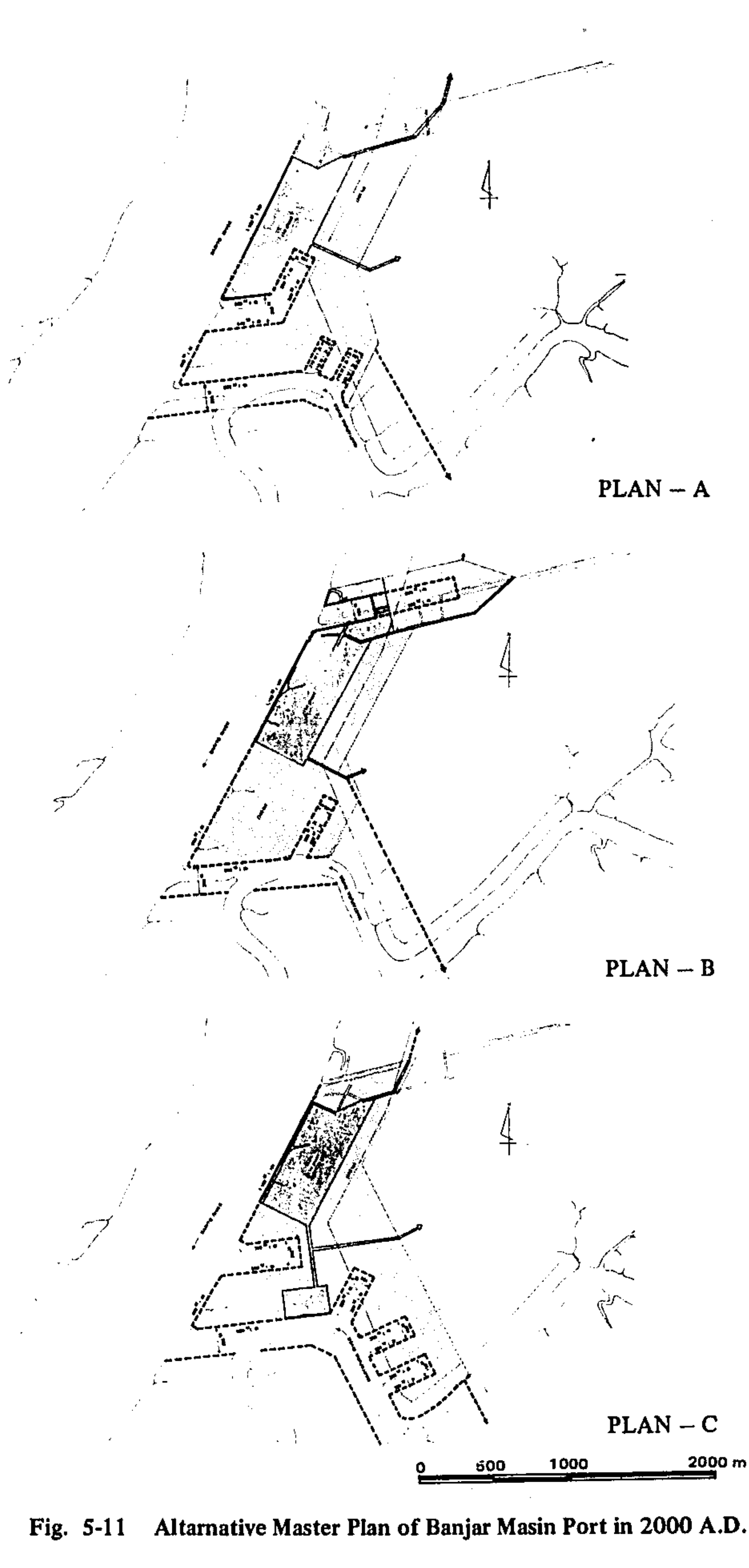


Fig. 5-11 Altarnative Master Plan of Banjar Masin Port in 2000 A.D.

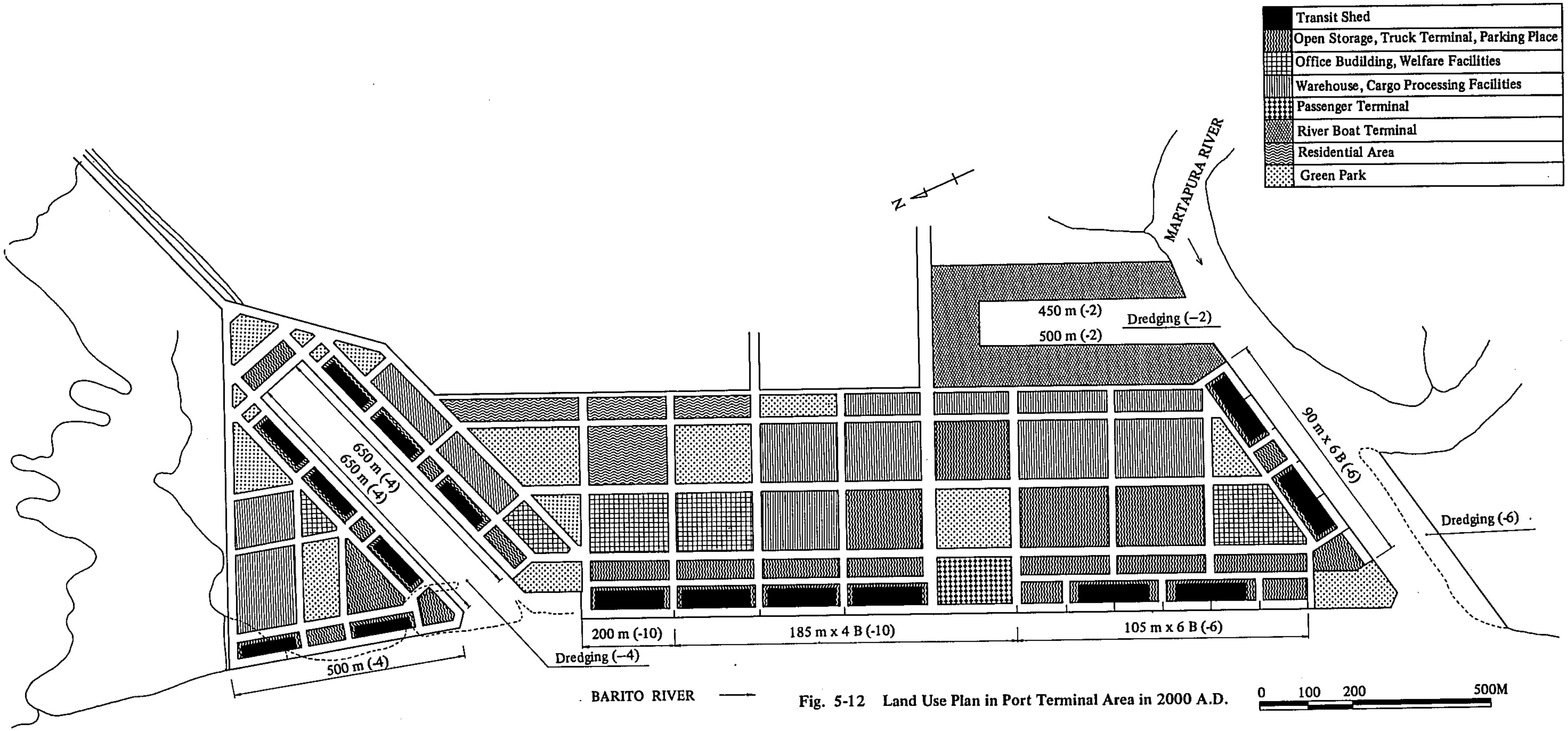


Fig. 5-12 Land Use Plan in Port Terminal Area in 2000 A.D.

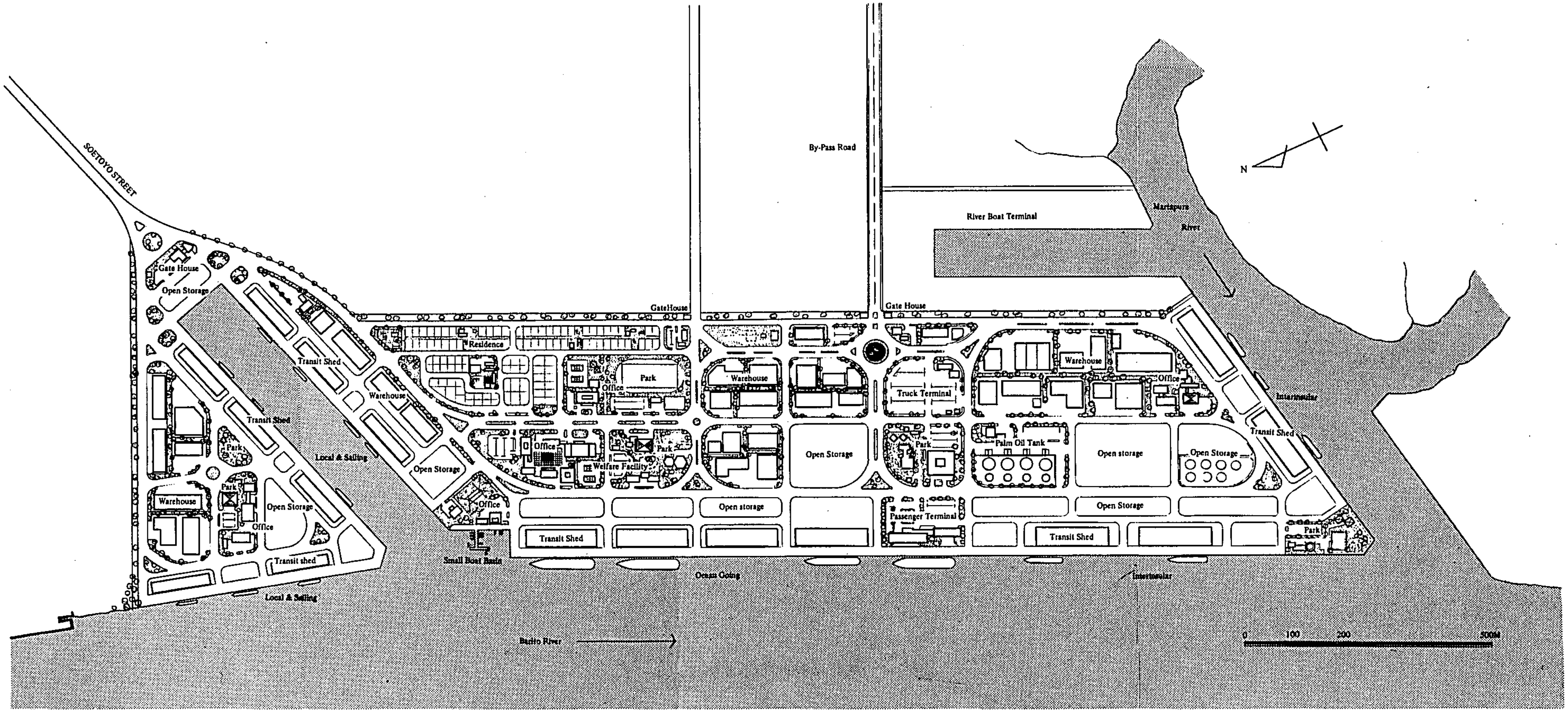


Fig. 5-13. Layout of Port Terminal Facilities (2000 A.D.)

5-4-2. In the alternative Plan B, a wharf for the ocean-going vessels is planned to be built downstream of the present Trisakti Wharf and a wharf for interinsular vessels from further downstream of the wharf to Martapura Short Cut and along the banks of the Short Cut is planned to be built. With regard to the wharf for the local vessels and the sailing vessels, consideration was given to the idea that an excavated anchorage should be built along Tik Dalam river which runs into the upstream of the Trisakti Wharf and that all the wharfs should be built along the banks of the excavated anchorage. But, in order to further save the expenses accompanying the dredging work, part of the wharf for the local vessels and sailing vessels is to be built along Barito river upstream of the Trisakti Wharf in this report. Also in this report, the reduction of the quantity of mud accompanying the excavation is intended by shortening the length of excavation and also by shrinking the width of 150 meter reported in the interim report to a new 125-meter width.

Small vessels like river boat and water bus, are planned to be anchored at an excavated mooring basin at the back of the Martapura Short Cut. This is the same idea as reported in the Interim Report.

In this plan, it was intended that the Martapura Wharf be amalgamated to a new port and harbor terminal which will be built in the future and that the base for the local vessels and sailing vessels be located to a site which is most convenient to the center of Banjarmasin city. But there are many houses and factories around the mouth of the Tik Dalam river, their smooth transfer is a subject to this plan.

The excavated mooring basin is to be built at an angle of about 60 degrees downstream to the Barito river so that the entry of the ships approaching from the downstream of the Barito river becomes easy. The angle is almost the same as the angle at which the Martapura river runs into the Barito river. The excavated mooring basin is designed to be 4 meters depth. There is a gut along the east bank of the Barito river. Once out of the mooring basin, there is a water depth of 10 meters or so. Therefore, there is no worry about the siltation of the mooring basin with the muddy sand flowing in the Barito river.

5-4-3. The concrete ideas on the layout of the facilities in the alternative Plan-B are described in the sections starting with paragraph 5-5. However, the Banjarmasin port in 2000 A.D. is not designed in this report to be an ultra-modern port which will need a special container wharf and a special LASH system facility. Therefore, the port terminal operation unit, unit in tons per hectare, . will be calculated as 29,000 tons/ha, if the port terminal area is planned about 130 ha in 2000 A.D., and total amount of port cargo of 3,740,000 tons will be handled there in same period expected. In terms of the port terminal area, there is much room.

The land utilization plan of the port terminal area of about 130 ha. is shown in Fig. 5-12 and Table 5-18.

5-4-4. A port terminal area measuring about 2.5 kilometers in length and 500 - 750 meters in width is planned to be built in parallel with the Barito river and alongside of bank. Almost all of the water front line of the projected port terminal is used as the

Table 5-18 Land Use in Port Terminal Area in 2000 A.D.

Facilities	Area (ha)	Share (%)
1) Transit Shed	7.20	5.6
2) Open Storage, Parking Place	17.73	13.7
3) Truck Termisal	2.08	1.6
4) Palm Oil Tank Yard	1.00	0.8
5) Warehouse, Cargo Processing Facility	23.42	18.1
6) Green Park	14.62	11.3
7) Office	7.77	6.0
8) Residence	5.33	4.1
9) Passenger Terminal	1.68	1.3
10) Road	29.40	22.7
11) Apron	8.25	6.4
12) River Boat Terminal	10.80	8.4
Total	129.28	100.0

quay. The total length of the quay including the transitional part of berth reaches about 5,600 meters. Right behind the wharf, transit sheds and open storages are laid out beyond the 20-meters wide apron of wharf. At the wharf for the ocean-going vessels, the open storages are placed behind the transit sheds. These open storages are prepared for the cargo handling and temporary stocking of large machinery and plants which do not go through the transit sheds. Taking into account the possibility that those open storages will be used, in the future, for the cargo handling of containers which is loaded mixed with general cargo and the increase of transport vehicles, an additional spacious open storage space was secured in the center of the port terminal area. The total area including the parking place reaches 17.7 ha.

The administration buildings like ADAPEL, KEDAPEL, Customs, are built, centering around the existing Banjarmasin Port Administration building. A small administration building site for the building of a branch office each in the Interinsular vessels wharf area downstream of the Barito river, Local & Sailing vessels wharf area upstream of the Barito River and near the gate is arranged. (See Fig. 5-14)

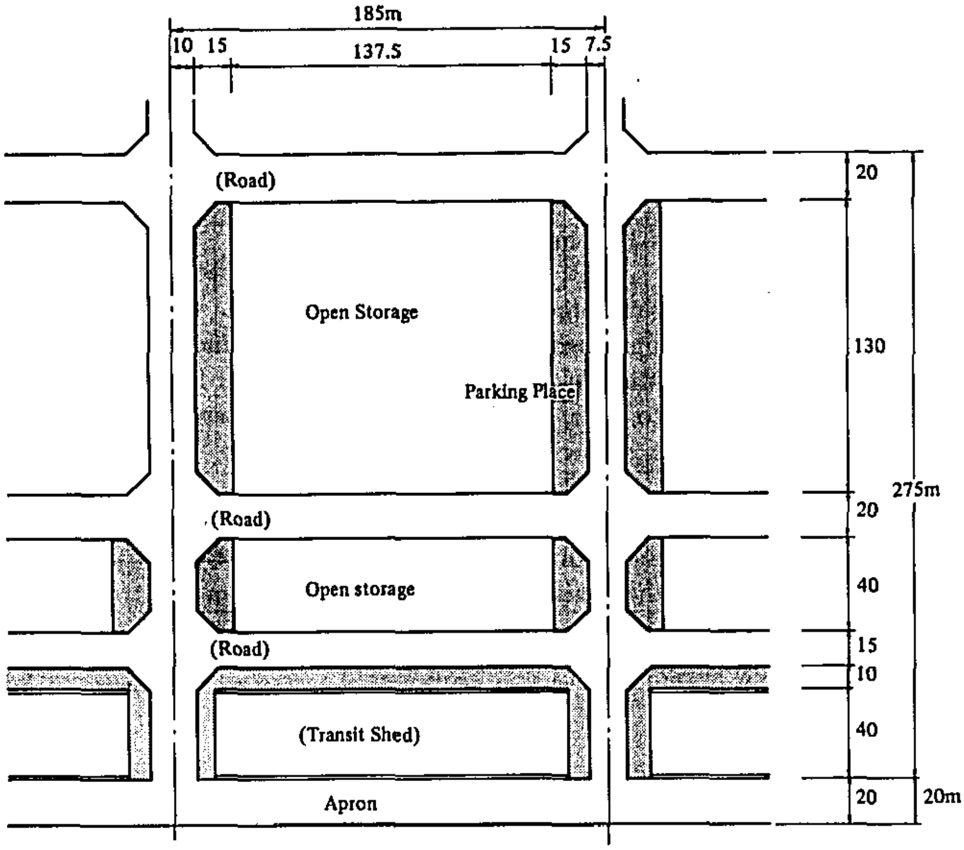
The reason why the administration building site is arranged around the existing administration building site is that the existing facility can be best utilized in the stepwise development plan and that this area is expected to become the center of the terminal area in the future. This area has much room for the building of the welfare facilities and sports facilities for the governmental staff and their families. The total planned area reaches 7.8 ha.

The residential site for the staff is arranged in the most quiet place at the back of the administration building site, and around the residential site is arranged sufficient green belt for the preservation of the life environment. At the initial stage of the stepwise development, it is better to offer the residential site for the staff and give consideration to the smooth transfer of the existing facilities when development work is carried out in the Local & Sailing Vessels wharf area located upstream of the Barito River. The total area for the residential site is 5.3 ha. and can accomodate 150 - 200 flat houses with standard size.

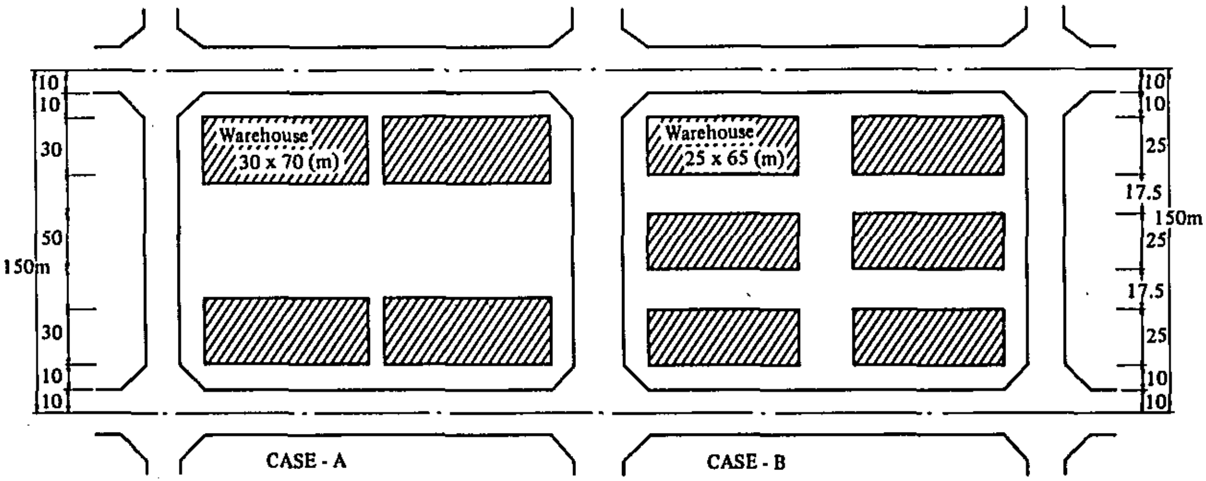
A passenger terminal is planned to be built almost at the center of the wharf or on the border where the ocean-going wharf meets with the Interinsular vessels wharf for the convenience of both domestic and foreign passengers. A total land area of 1.7 ha. including the terminal building, parking lot, and green belts is secured.

The tank yard for the palm oil is arranged behind the warehouse and the open storage because of the assumption that the use of the palm oil loading wharf should be shared with the general cargo goods. The loading of the palm oil is carried out by means of the buried pipelines in the wharf. The transport of the palm oil to the wharf from the producing area is assumed to be all by means of tank lorries. This requires a wide space for their parking during their cargo handling. For this tank yard a total land area of 1.0 ha. is secured. (See Fig. 5-15)

The general warehouses are arranged behind each wharf at the center of the terminal area. The warehouse is assumed to be one-storied. Taking into account the simple work for packing or labelling needed for the physical distribution, a total land area of 23.4 ha.



OPEN STORAGE & PARKING PLACE



CASE - A

Warehouse Area/Site Area = 40%

CASE - B

Warehouse Area/Site Area = 45%

LAYOUT OF WAREHOUSE

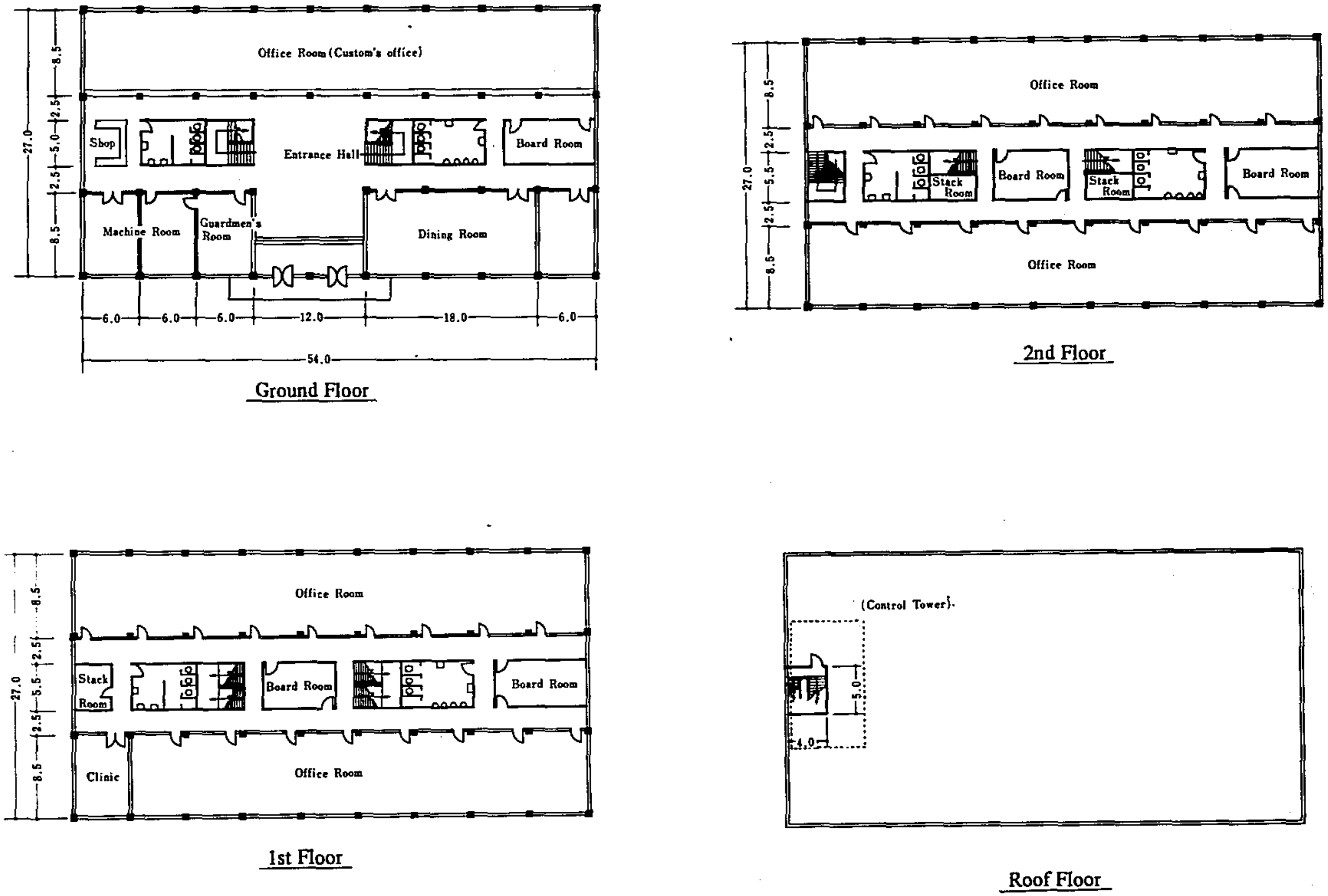


Fig. 5-14 Plan of Administration Office (Unit : m)

is allocated for the general warehouses. If they are two storied, there is room given as a result of this.

The water supply and the power supply facilities are planned to be built in the most deepest area of the terminal area. Only small land area is required for them, so it is no problem to prepare the site for them in any time if necessary.

The oil supply facilities for oil bunkering include the oil stock tanks, tank lorry parking lot, pipelines to the special wharf, are planned to establish. But pipeline connected with each wharf of all is not arranged. An oil supply system was considered sufficient which receives the oil in Oil Barges from a particular wharf downstream of the Barito River, and bunkering works are done by using Oil Barge for the vessels.

At the back of the Martapura Short Cut are arranged a mooring basin connected to a loading yard with an extension of 1,000 meters and a land area of 10.8 ha. as the base for the small vessels like river boats, water buses which are the water transport means to the hinterland. Detailed facilities are not given here but various facilities including markets can be located here.

At any rate, it is desirable to intend the stepwise development depending upon the demand. Particularly, with the mooring basin, it is not necessary to excavate if the demand is small. Instead, since it is possible to use the water front along banks of the Martapura Short Cut as the wharves for small size vessles further detailed study is needed.

Approaching the port terminal will be operated by through three roads line established as dock road. The most upstream road is the existing Soetoyo road, which is palnned to get strengthened by expantion of width and rehabilitation of pavement. This road links the terminal with the center of Banjarmasin city in the shortest distance.

The road in the middel is expected to become the main road linking the terminal with the urban district which is expected to expand towards the Barito River in the future. The Banjarmasin municipality has this road already in its planning.

The most downstream road which does not pass through the urban area of Banjarmasin city is a by-pass responsible for the physical distribution to the hinterland. The road crosses the Martapura river over a bridge and joins an arterial road linking the Banjarmasin city with the city of Martapura.

Therefore, the truck terminal, palm oil tank yard, passenger terminal, and other facilities are arranged in such a manner that they are convenient to the connection to the last road.

At the entrance of each road to the port terminal, individual gates and checkpoints are to be built. The port terminal area is surrounded with fences. The foreign trade facilities area is separated by the fences as the bonded area, and four gates with the customs offices are to be built. (See Fig. 5-16)

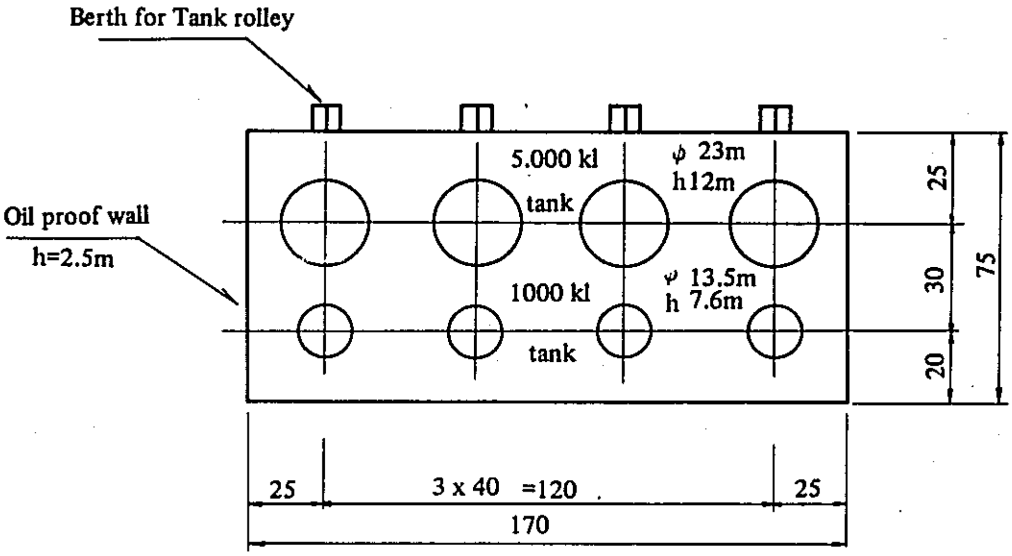


Fig. 5-15 Layout of Palm oil Tank yard.

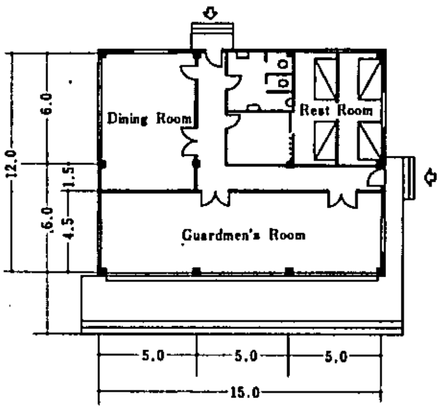


Fig. 5-16 Plan of Main Gatehouse (Unit : m)

5-5. Depth of Channel

5-5-1. General

If L.W.L. is the datum level, the required depth of the channel "D" is expressed by the following equation.

$$D = D_1 - D_2 + D_3 \qquad (1)$$

where D_1 : Designed draft
D_2 : Expected sea level
D_3 : Keel clearance

The required depth of channel "D" was calculated for each kind of ship covered by this planning, and as a result, 6m was obtained. Therefore, the present depth of channel of 6.0 m can meet the draft of calling vessels not only in 1983 but also up to 2000 A.D.

According to past experience, ship size forecast for more than 10 years does not come true in most cases. If the real tendency in ship size begins to deviate greatly from this planning this forecast must be reviewed. If Indonesian economy advances greatly and the regularity of shipping service becomes required severely, the Expected Sea Level should be used more small value. The keel clearance was held down to the smallest in this planning in order to keep the cost in low level. However, it is of course desirable that the keel clearance is large for shipping service, and after actual application, it may become necessary to review it, hearing the opinions of operators.

5-5-2. Designed Draft

The designed draft D_1 as the maximum draft of calling vessels is determined by the sizes of calling vessels and the states of cargo loading at the time of calling. A vessel which does not call usualy in full load condition does not be considered the vessel with the maximum draft for this port, even if the size of the as the vessel is the largest among calling vessels. This applies to the vessels for liner service, and the states of cargo loading must be assumed for considering the drafts of ocean going liners and domestic travel liners. Also in the case of tramp vessels, if loading in 2 part is employed, the states of cargo loading must be assumed. But this was regarded exceptional, and excluded from the consideration.

As the size of ocean going liners in 2000 A.D., 15,000 DWT is assumed (see paragraph 3-6). The full-load draft corresponding to this size of vessel is 9.5m. The quantitative balance of liner trade is assumed to be improved in2000A.D., and the cargo loading rate at the time of calling at Banjarmasin Port is assumed to be maximum 50%. The draft at this time is 7.3m, and this is taken as the designed draft.

Aa for log carriers, a draft of 7.7m for 10,000 DWT in full load is employed for planning. This 7.7m is different from the full-load draft for 10,000 DWT of ocean going liners in 1983, due to the difference between general cargo vessels and bulk carriers.

Also for ore carriers, the designed draft of 7.7m is employed, considering in the same way as log carriers. Unlike the data for timber, there are no concrete data concerning ores, such as whether or not they are produced, where they are produced, what are produced, and so on. As described in the Chapter for forecast for port traffic, this is presented just as possible export cargoes. If ores for export are more concretely identified, the method of transportation will have to be reconsidered accordingly. For example, if a large amount of ores with annual output of tens of million tons are produced in a place close to the sea, it will be possible to construct a sea berth in the Java Sea for export of the ores, irrespective of Banarmasin Port. In this case, the optimum size of ore carriers will be more than tens of thousand DWT. If ores warranting high freight charges are exported, liners will be used, too, in addition to tramp vessels. Anyway, at the present stage, it is appropriate to assume that ore carriers will be similar to log carriers which are now provided with concrete data.

Of domestic travel vessels, RLS vessels and non RLS vessels are large in ship size, and non RLS vessels can be assumed to be in full load. Therefore, as for domestic travel vessels, 5.7m is taken as designed draft for full load of 3,000 DWT with both general conventional cargo vessels and tankers.

5-5-3. Expected Sea Level

For determining the depth of channel in a sea area whith tidal range, the setting of Expected Sea Level (D_2) is made large, large vessels can be passed in a shallow channel, and the cost of dredging can be kept low. However, if "D_2" is too large, sailing opportunities and navigation allowing time are reduced, and as a result, the stand-by time of vessels increases, raising sailing cost. In this case, the port is refrained from calling at by shipping interests, and the port cannot prosper.

The vessels required to observe more regular service desire more keenly the depth of channel which allows entrance and departure irrespective of sea level. However, in general, the time of high tide level comes once or twice a day. Therefore, even if the operation to allow passing the channel in the daytime only is employed, vessels sailing on schedules by day have a large allowance for sea level. For this reason, D_2 can be made large generally for ocean going vessels, and must be made small generally for domestic travel vessesl.

Table 5-19 shows the total periods of time during which the sea levels given in the upper column occurred respectively in 13 hours in the daytime from 6 to 19 o'clock at the mouth of the Barito River. They are based on the data actually measured in February, May, August and November, 1976. According to the table, the period of time to have sea levels of more than Zero meter was 13 hours (100%), and that for more than 1.0 m was 11.2 hours (59.9%), that for more than 2.0 m being 3.4 hours (26.3%), respectively on the average per day. Sea levels of more than 2.5 m appeared for 0.5 hours (4.1%) only out of 13 hours in the daytime in a day. Even if it is assumed that a vessel sails at 5 knots in the dredged channel of 14.5 Km, it takes an hour and a half. In view of this, D_2 must be 2.0 m or less.

Table 5-20 shows the rates of days when the sea levels given in the upper column did not appear at all in 13 hours in the daytime. There was no day when a sea level of 1 m did not appear at all, and the rate of days when 1.5 m did not appear at all was 5%, that for 2.0 m being 27%, and that for 2.5 m being 79%. Seeing monthly distributions, in November, 1976, sea levels were generally low, and the days when 1.5 m did not appear at all accounted for 20% of the whole, those for 2.0 m accounting for 70%.

Therefore, for ocean going liners which are scheduled by day, and for ocean going tramp vessels which are scheduled under a large degree of freedom, D_2 = 2.0 m will be able to be employed. In November when there were many low sea level days, the period during which the sea level did not reach 2.0 m occurred 3 times intermittently. Therefore, shipping efforts are expected to manage by assigning vessels to avoid the periods, or by making the draft small when calling at the port during the periods only, etc.

With regard to RLS vessels and non RLS vessels of domestic travel vessels, D_2 = 1.0 m is taken considering Tables 5-19 and 5-20, since it is surmised that they will be required to provide regular service as the Indonesian economy progresses.

5-5-4. Keel Clearance

The factors to be taken into consideration for determining the Keel Clearance of channel are usually as follows:

Waves
Current
Wind
Traveling speed of vessel

Waves and wind at the mouth of the Barito River are not so influential as to cause hull sinking and can be almost neglected. As for current, the tidal current for the duration of ebb is fast, but the current direction is almost along the dredged channel. Therefore, the current does not cause the pitching or rolling of hull. For this reason, current is not a factor for keel clearance. If traveling speed is about 5 knots, a hull sinks about 30cm by sailing, even in the case of restricted channel. Therefore, expecting a proper control of traveling speed will be imposed, D_3 = 0.3 m is taken.

5-5-5. Depth of Channel

Table 5-21 shows the processes of calculating depths of channel in 2000 by kinds of ships. According to the table, the depth of channel with L.W.L. as datum level is 5.6 m for ocean going liners, 6.0 m for tramp vessels, and 5.0 m for domestic travel general cargo boats and domestic travel tankers. Therefore, 6.0 m is employed as the depth of channel in the planning. For the passenger vessels, the size of which was not forecast, if the depth of channel is 6 m, vessels up to 7,000 GT in full load can sail, with the sea level as 2.0 m.

Table 5-19 Navigable Daytime Hours by Sea Level at Barito River Mouth

	Unit	Sea level					
		0.0 m or more	0.5 m or more	1.0 m or more	1.5 m or more	2.0 m or more	2.5 m or more
Feb. 1976	hours	377	368	288	193	81	11
May 1976	hours	403	403	401	353	218	50
Aug. 1976	hours	403	403	384	307	99	4
Nov. 1976	hours	390	390	284	90	15	0
Total (A)	hours	1,573	1,564	1,357	943	413	65
(A)/1,573 x 100 (%)	%	100	99.4	86.3	59.9	26.3	4.1
Average navigable daytime hours a day	hours per day	13	12.9	11.2	7.8	3.4	0.5

Table 5-20 Probability of Nonexceedance by Sea Level at Barito Estuary

Sea level	1.0m	1.5 m	2.0 m	2.5 m
Feb. 1976	0 days	0 days	5 + 3 = 8 days	13 + 9 + 1 = 23 days
May 1976	0	0	0	2 + 6 + 7 = 15
Aug. 1976	0	0	3 + 1 = 4	7 + 1 + 20 = 28
Nov. 1976	0	2 + 4 = 6	5 + 10 + 6 = 21	30
Total (A)	0	6	33	96
Feb. 1976	0 %	0 %	28 %	79 %
May 1976	0	0	0	48
Aug. 1976	0	0	13	90
Nov. 1976	0	20	70	100
(A) ÷ 121	0	5	27	79

Note: 1) Figures mean the accumulation of the day which the indicated sea level was never exceeded in its daytime from 6 o'clock to 19 o'clock.

2) 5 + 3 = 8, for example, shows that sea level of 2.0 m was never exceeded in the daytime during 5 days and, after some interval, during 3 days in succession

Table 5-21 Calculation of Depth of Water of Access Channel (2000)

Kind of vessels	Ship size	Draft in full cargo	Cargo loading rate	Draft D_1	Expected sea level D_2	Keel clearance D_3	Depth of channel D $= D_1 - D_2 + D_3$
	DWT	m		m	m	m	m
Ocean going vessels							
Liners	15,000	9.5	0.5	7.3	2.0	0.3	5.6
Tramp vessels timber	10,000	7.7	1.0	7.7	2.0	0.3	6.0
ore	10,000	7.7	1.0	7.7	2.0	0.3	6.0
Domestic trade vessels							
General	3,000	5.7	1.0	5.7	1.0	0.3	5.0
Tankers	3,000	5.7	1.0	5.7	1.0	0.3	5.0

5-6. Deep Sea General Cargo Berths

5-6-1. As is described in paragraph 6-6-1, the ocean-going vessels wharf to be built by 1983 is designed to be −10 meters in structure, so if the access channel at the estuary becomes deeper from −6 meters in the future, cargo ships of 15,000 dead weight tons can be anchored at the wharf. If an assumption is made that even in 2000 A.D. the transport at this port will be depending upon the conventional types of ships, it is considered correct to carry out the facilities planning aiming at the 15,000 – D.W.T. ships which are becoming the major transport means for the conventional general cargo goods

The cargo handling capacity of the wharf described throughput capacity in PELITA II is set at 800 ~ 900 tons/m as a target at a target year. But the target cargo handling capacity of the wharf where the general cargo goods for the foreign trade will be handled in 2000 A.D. is set at 1,000 tons/m as a result of the taking method of unit-packed cargoes system, mechanization of cargo handling, and use of large-scale cargo handling equipment. (See Table 5-22)

The value of this order is realized at Japan's major general cargo goods handling wharfs. It is also realized at Tg. Priok port in 1974 – 1,010 tons/m. Therefore, the target value of 1,000 tons/m is considered realizable.

It is know from Table 5-1 that the foreign trade cargo goods to be handled at the wharf in 2000 A.D. is 1,040,000 tons and that the conversion to the general cargo goods gives 930,000 tons. The total extension of the wharf is found from this to be 930 meters. Based on the above assumption, it is planned in this plan to build four new berths, each being 185 meters, in addition to the existing 200-meter wharf, making the total extension of the wharf 940 meters.

It is assumed in the Interium Report that 1/2 of the processed timbers shipped for this port is loaded from the wharf and the remaining 1/2 of them is loaded at the anchorage to the ship. In this Plan, however, it is assumed that all of the processed timbers are loaded onto the barges from the waterline of the timber mill and that they are loaded to the ship at the buoy berth. The decrease in the quantity of the foreign trade cargo goods to be handled at the wharf is due to this assumption in comparison with the quantity as described in the Interium Report.

5-6-2. The quantity of the foreign trade cargo goods to be handled at the wharf in 2000 A.D. is broken down into 240,000 tons of imports and 800,000 tons of exports. It is forecast that the imports will be made up of consumer goods and that the exports will be made up of, mainly, agricultural products like estate crops and their processed products. The flow which is caught at the wharf in the same manner as in paragraph 6-6-3 on the basis of the quantity of these cargo goods is shown in Table 5-23. The scale of the standard services facilities which will become necessary in this case is shown in Table 5-24.

On the assumption that the estate crops may include the palm oil in addition to rubber, the loading facilities including the palm oil tanks are planned.

Table 5-22 Cargo Throughput at Wharves for Foreign Trade

Unit: ton/m · year

Name of Port/Wharf		Cargo Throughput	Remarks
Trisakti Wharf Banjarmasin Port		584	in 1975
Tg. Priok Port		1,010	in 1974
Surabaya Port		900	in 1975
PELITA II		800 - 900	1974/75 - 1978/79
Estimated Capacity	1,983	900	
	2,000 A.D.	1,000	

Table 5-23 Estimated Foreign Trade Cargo Flow at the Wharf in 2000 A.D.

Unit: 1000 tons

Kind of Cargo	Cargo to be handled at the Wharf	Cargo Flow			
		Transit Shed	Open Storage	Tank Yard	Direct Trnasport to/from Hinterland
1) Export	800	474	48	225	53
Logs	-	-	-	-	-
Processed timber	-	-	-	-	-
Rubber, Other Estate Crops	360	135	-	225	-
Minerals	-	-	-	-	-
Others	440	339	48	-	53
2) Import	240	50	108	-	82
Total	1,040	524	156	225	135

Table 5-24 Required Area for Major Cargo Distribution Facilities for Foreign Trade in 2000 A.D.

Facilities	Area (m^2)	Remarks
1. Transit Shed	24,300	Indicates the floor area for the transit shed. In addition to one existing transit shed, three transit sheds, each being 150m x 40m, are to be built.
2. Open Storage	18,600	Indicates the paved area for cargo distribution and temporary cargo storage.
3. Palm Oil Tank Yard	10,000	Indicates the required total area for the foreign and domestic trades combined. Four 5,000 kℓ tanks are to be built.
4. Warehouse	26,700	Indicates the floor area for the warehouse.

Note 1: The required area for the transit shed was calculated on the basis that the quantity of cargo storage per unit area is 2.0 t/m^2; the rotation is 18 times per year; and the cargo storage ratio is 0.6.

Note 2: The required area for the open storage was calculated on the basis that the quantity of cargo storage per unit area is 2.0 t/m^2; and the rotation is 6 times per year; and the cargo storage ratio is 0.7.

Note 3: The required area for the warehouse was calculated on the basis that the quantity of cargo storage per unit area is 2.0 t/m^2; and the rotation is 6 times per year; and the cargo storage ratio is 0.6.

5-6-3. It is appropriate to build the ocean-going vessels wharf, as shown in fig. 5-12, in connection with the downstream side of the deep Trisakti Wharf. The wharf which will be shared with the Interinsular vessels at the time of 1983 are usable as the wharf exclusively for the ocean-going vessels at the time of 2000 A.D.

5-7. Regional Harbour Facilities

5-7-1. The vessels that should be berthed alongside the regional harbour facilties shall, it is considered, include interinsular vessels, local vessels, sailing vessels and small type river boat for waterborne transportation with the port service area.

In regard to the types of these various domestic bound vessels, and the shares of the cargoes in 2000 A.D. that shall be transported, the presumption is made with the same as in 1983, which is to be commented in Paragraph 6-7.

Whilst on determination of the capacities, the cargo handling capacity of each wharf is assumed as is given in Table 5-25, with reference to the studies on such main harbours as Tg. Priok and Surabaya of Indonesia and of Japanese harbours.

On the other hand, it is estimated that inbound trade cargoes that shall be handled at this wharf will amount to 2,700,000 tons in 2000 A.D. and the conversion value thereof into general cargo amounting to 2,120,000 tons, as is to be drawn from Table 5-1, the lenght of quay necessary for interinsular vessels shall be of approximately 1,180 m.

Based on the above plans, this plan intends to build 6 new berths – 105 meters each (3,000 DWT) and 6 new berths – 90 meters each (3,000 DWT), with the total extension of the wharf being 1,170 meters.

The extension required for the Local and Sailing vessels wharf is 1,770 meters, and since the existing Martapura wharf is planned to be discarded by the year of 2000 A.D., it is necessary to build the above total extension. The extension of wharf required for the foreign trade and domestic trade is given in Table 5-26.

Since it is assumed that there will be substantially large quantities of cargo goods which will be carried by the water transport linked with the service area, a loading space for the small vessels is arranged.

5-7-2. The breakdown of 2,700,000 tons of the domestic trade cargoes be handled at the wharf in 2000 A.D. shall be, 1,700,000 tons of inbound domestic trade, 1,000,000 tons of outbound domestic trade, the main commodities of inbound trade shall be fertilizer, construction materials and machinery etc. and the main commodities of the outbound trade shall be agricultural products.

If the cargo flow on the wharf were obtained by a method similar to that in Paragraph 6-7-4 using these cargo volume as the basis, the results would be as shown in

Table 5-25 Cargo Throughput at Wharves for Domestic Trade

Unit: ton/m · year

Name of Port/Wharf		Interinsular	Local and Sailing	Remarks
Trisakti Wharf Banjarmasin Port		584	–	in 1975
Martapura Wharf Banjarmasin Port		–	474	in 1975
Tg. Priok Port		672	–	in 1974
Sunda Kelapa Port		–	590	in 1973
Surabaya Port		553	164	in 1975
PELITA II		800 ~ 900		1974/75 ~ 1978/79
Estimated Capacity	1,983	700	500	
	2.000 A.D.	900	600	

Table 5-26 Required Quay Length in 2000 A.D.

Unit: m

Kind of Quay	Length	Remarks
Quay for Ocean Going Vessels	940	200^m x 1 Berth (existing) 185^m x 4 Berths (new establishment)
Quay for Interinsular Vessels	1,170	105^m x 6 Berths (new establishment) 90^m x 6 Berths (new establishment)
Quay for Local and Sailing Vessels	1,770	$1,770^m$ (new establishment)

Table 5-27 and in this case the scope of the standard service facilities believed necessary would be as shown in Table 5-28.

On the assumption that the estate crops may include the palm oil in addition to rubber, the loading facilities including the palm oil tanks are planned.

5-7-3. As shown in Fig. 5-12, the Interinsular vessels wharf are to be built, centering around the mouth of the Martapura Short Cut. The 630-meter wharf (105 meters x 6 berths) is to be built along the banks of the Barito River, and the 540-meter wharf (90 meters x 6 berths) is to be built along the banks of the Short Cut.

With regard to the local and sailing vessels wharf, 470 meters are built along the banks of the Barito river upstream from the mouth of the Tik Daram River which runs into the upstream side of the Trisakti Wharf and 1,300 meters are built along the bank of the mooring basin excavated along the Tik Daram River. A corner at the upstream end of the existing Trisakti Wharf – the place close to the entrance to the excavated mooring basin – is used for the mooring of the official vessels.

5-8. Passenger Terminal

Paragraph 3-5-7 indicates that the number of incoming and outgoing passengers at the Banjarmasin port in 2000 A.D. shall be of approximately 56,000 passengers, which in comparison with that of 1975 shows the increase by 5.2 times.

It amounts to in average 156 passengers per day.

These incoming and outgoing passengers are expectedly for domestic travel, so for the time being, it would be suitable to paln establish a small scale passenger terminal at the plot, adjacent to the wharf for interinsular vessels.

In case pilgrimage boat shall sail from this port to Mecca, the number of passenger per vessel shall increase by the departures and arrivals of ocean going vessels.

The construction of the passenger terminal shall be required wherein the proceedings as to entry into and departure from the country, clearance, and quarantines should be conducted.

In the cost estimation as described in paragraph 5-10, it is assumed as shown in Fig. 5-17 that 1/2 of the above passengers are those transported by the ocean-going vessels. Based on this assumption, the required facility scale and the cost were studied. Consideration should be given so as not to give disturbances, taking into account of the size of the passenger terminal and the time of construction.

Further at the loading place, which is planned at the innermost of shortcut of the Martapura River, for serving transportation of small boat such as river boats and water buses connected between port and its service area, the arrivals and departures of numerous passenger shall be operative so that relevant passenger terminal must also be considered.

Table 5-27 Estimated Domestic Trade Cargo Flow at the Wharf in 2000 A.D.

Unit: 1000 tons

Kind of Cargo	Cargo to be handled at the Wharf		Cargo Flow							
			Transit Shed		Open Storage		Tank Yard		Direct Trnasport to/from Hinterland	
1) Outbound Domestic	1,000		270		307		70		353	
Processed Timber		–		–		–		–		–
Others		1,000		270		307		70		353
2) Inbound Domestic	1,700		680		170		–		850	
Oil		–		–		–		–		–
Others		1,700		680		170		–		850
Total	2,700		950		477		70		1,203	

Table 5-28 Required Area for Major Cargo Distribution Facilities for Domestic Trade In 2000 A.D.

Facilities	Area (m^2)		Remarks
1. Transit Shed	44,000		Indicates the floor area for the transit shed.
Interinsular		22,000	Four Transit sheds, each being 150m x 40m, are to be built.
Local & Sailing		22,000	Eight transit sheds, each being 120m x 25m, are to be built.
2. Open Storage	57,000		Indicates the paved area for cargo distribution and temporary cargo storage.
Interinsular		28,500	
Local & Sailing		28,500	
3. Palm Oil Tank Yard	10,000		Indicates the required total area for the foreign and domestic trades combined. Four 1000 kℓ tanks are to be built.
4. Warehouse	56,100		Indicates the floor area for the warehouse.

Note 1: The required area for the transit shed was calculated on the basis that the quantity of cargo storage per unit area is 2.0 t/m^2; and the rotation is 18 times per year; and the cargo storage ratio is 0.6.

Note 2: The required area for the open storage was calculated on the basis that the quantity of cargo storage per unit area is 2.0 t/m^2; and the rotation is 6 times per year; and the cargo storage ratio is 0.7.

Note 3: The required area for the warehouse was calculated on the basis that the quantity of cargo ratio is 0.6.

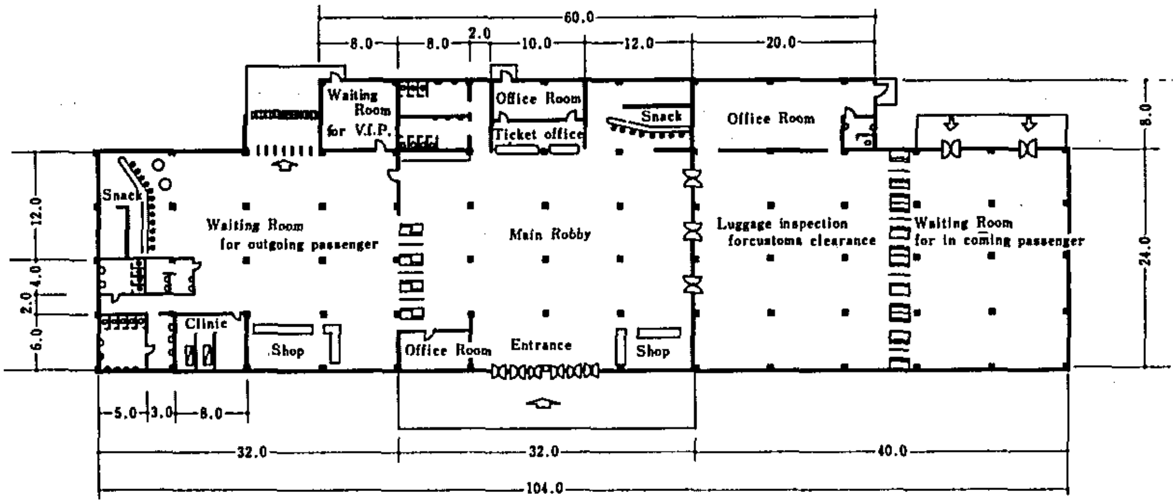


Fig. 5-17-(1) Plan of Passenger Terminal (International) (Unit : m)

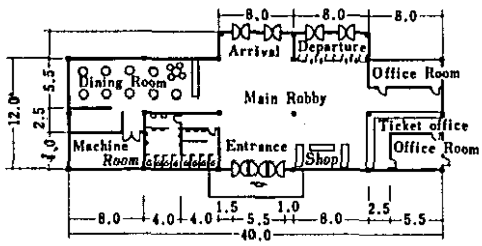


Fig. 5-17-(2) Plan of Passenger Terminal (Domestic) (Unit . m)

5-9. Mineral Ore and Timber Loading Basin

As is shown in Table 5-1, the quantities of mineral ore and processed timber that shall expectedly be handled at the port of Banjarmasin in 2000 A.D. will amount to 800,000 tons and 1,500,000 tons respectively in combination of foreign trade and inbound domestic trade.

Among them, such case is expected as the mineral ore shall be exploited in the port service area by the year of 2000 A.D. and be carried out by the rivers. It shall be transported by barge from the upstream down to this port, and shall be transshipped to the larger vessels for export.

The method of shipping shall vary with the method of transportation from the upstream point down to this Port, and the mechanism for loading for the larger vessels, however, concrete plan for these facilities shall not be made herein. Anyhow, it is expected that the handling on the water shall be undertaken.

From the standpoint that the materials woods for the processed timbers are transported in raft from the upstream by way of the Barito river, it is assumed that the processing mills for the most part will be located at the waterfront rather than in the inland areas. Therefore, it is assumed that the loading of processed timbers to the ship will be made by means of the barges at the buoy berth. Assuming that the cargo handling capacity of mineral ores and processed timbers at the buoy berth is 200,000 tons/year, 12 berths are needed.

6 buoy berths are to be built each at the upstream side and downstream side of the wharf. Assuming that the ships mooring at both ends of the series of the berths are to be moored with their sterns moored to the buoys and their bows fixed by their own anchors, five buoys at each point will do the purpose and 10 buoys in all are needed (See Fig. 5-18).

5-10. Cost Estimation

5-10-1. The cost of construction estimated by the type of structures and facilities is shown in Table 5-29. The conversion rate to the dollar is 415 rupies to the U.S. one dollar. The contingency which are 30% of the total cost are included. This is because the possibility is anticipated that there will be a modification in the design of the structure due to the appreciably poor soil conditions in the candidate area for the construction of the port and harbor terminal. The increase in cost during the construction period is not included in this cost estimation.

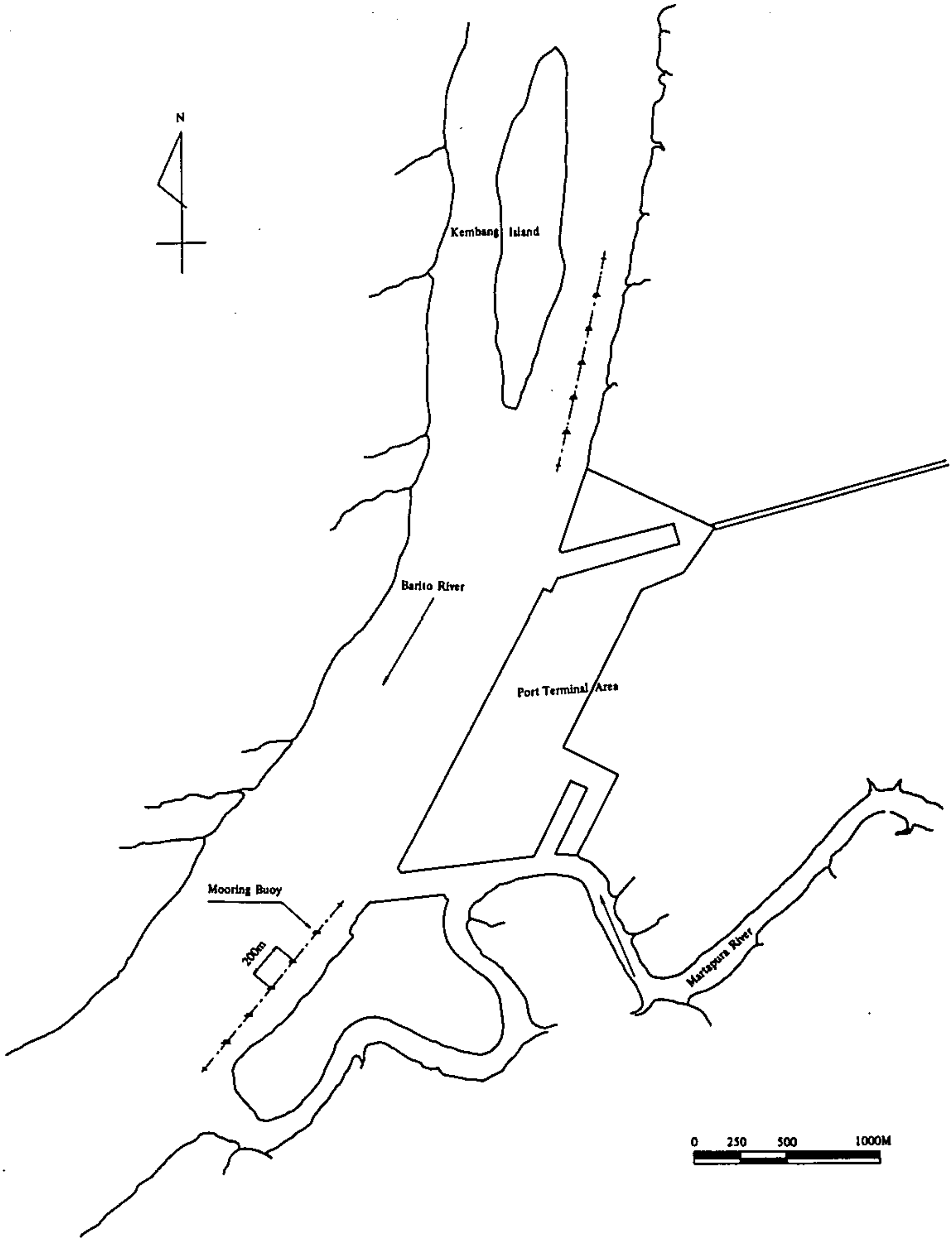


Fig. 5-18 Layout of Buoy Berths (in 2000 A.D)

Table 5-29 Estimated Capital Costs of PLAN-II (1978 – 2000 A.D.)

Unit: 1,000 U.S. Dollar

Activities	Quantity	Amount		
		Local	Foreign	Total
Land Acquisition & Compensation	Land Acquisition 907,600 m²	5,400	–	5,400
	Building Compensation 596,800 m²			
Earth Works & Drainage Works	1,292,800 m²	12,070	–	12,070
Dredging	1,298,300 m³	2,600	4,880	7,480
Quay – 10 m	740 m	26,300	38,320	64,620
– 6 m	1,170 m			
– 4 m	1,770 m			
– 2 m	1,000 m			
Bulkhead	885 m			
Cargo Handling Equipment	204 Forklifts, 24 Mobilcranes	780	2,590	3,370
Transit Shed	72,000 m²	10,550	10,270	20,820
Open Storage, Truck Terminal, Parking Place	198,100 m²	1,990	1,110	3,100
Warehouse	82,810 m²	12,130	11,810	23,940
Road & Bridge	Road 294,000 m², 1 Bridge	5,910	3,520	9,430
Water Supply	SUM	890	500	1,390
Oil Supply	SUM	1,420	1,460	2,880
Electricity Equipment	SUM	1,730	960	2,690
Administration Office	1 Building	2,220	–	2,220
Passenger Terminal	2 Buildings	1,680	–	1,680
Palm Oil Tank	4 Tanks (5,000 kℓ), 4 Tanks (1,000 kℓ)	2,850	2,780	5,630
Mooring Buoy	10 Buoys	600	700	1,300
By-pass Road, Bridge	Road 264,000 m², 1 Bridge	10,660	9,230	19,890
Others	2 Truck Scales, 7 Gatehouses, Green 146,200 m²	1,140	160	1,300
Engineering		2,930	3,210	6,140
Contingency		31,160	27,450	58,610
Total		135,010	118,950	253,960

Note: All costs are based on 1976 construction prices.

5-10-2. As described in paragraph 5-3-3(4), together with the possible improvement of urban areas such as commercial areas in the environs, the redevelopment of the area in and around Martapura wharf will be necessary, by 2000 A.D. The present functions of Martapura wharf will be able to be replaced owing to the planned improvement and expansion of the new port. However, the wharf must be provided for the use by local and sailing vessels at least by 1983, and the redevelopment will be initiated after that.

The redevelopment will be able to be executed from about 1990, considering the development of urban areas and the period of port improvement at the riversides of the BaritoRiver.

The investment schedule and investment amounts are shown in Table 5-30.

The redevelopment of the area in and around the Martapura wharf should be carried out in the following two phases in order to preve-t unnecessary confusions.

(1) First phase of the schedule covers the reimprovement of the wharf including the dismantling of existing facilites, and the construction of a warehouse and market. (See Fig. 5-19)

(2) Second phase of the schedule covers the expansion of the wharf for passengers, and furthermore the improvement and construction of shopping facilities combined with surrounding commercial facilties. (See Fig. 5-20)

To cope with the increasing commodity transportation according to the development of the area in and around Banjarmasin city, it will be necessary to prepare a grade separation type truck terminal connected to the by-pass roads to connect between the port and the hinterland, together with the improvement of peripheral road networks.

Table 5-30 Investment Schedule for the Redevelopment around the Martapura Wharf

Facilities	1st phase (1990~1995)		2nd phase (1990~2000)		Total	
	Quantity	Const. cost (US$1,000)	Quantity	Const. cost (US$1,000)	Quantity	Const. cost (US$1,000)
Market	3,000 m^2	1,400	2,000 m^2	900	5,000 m^2	2,300
Commerce	3,500 m^2	2,100	9,000 m^2	5,400	12,500 m^2	7,500
Warehouse	4,000 m^2	1,200	2,500 m^2	700	6,500 m^2	1,900
Wharf (incl. dismantling cost of existing facilities)	150 m	1,700	150 m	1,700	300 m	3,400
Others	–	300	–	200	–	500
Total	–	6,700	–	8,900	–	15,600

Note: "Others" include a parking place, green zone, roads in the site and footways.

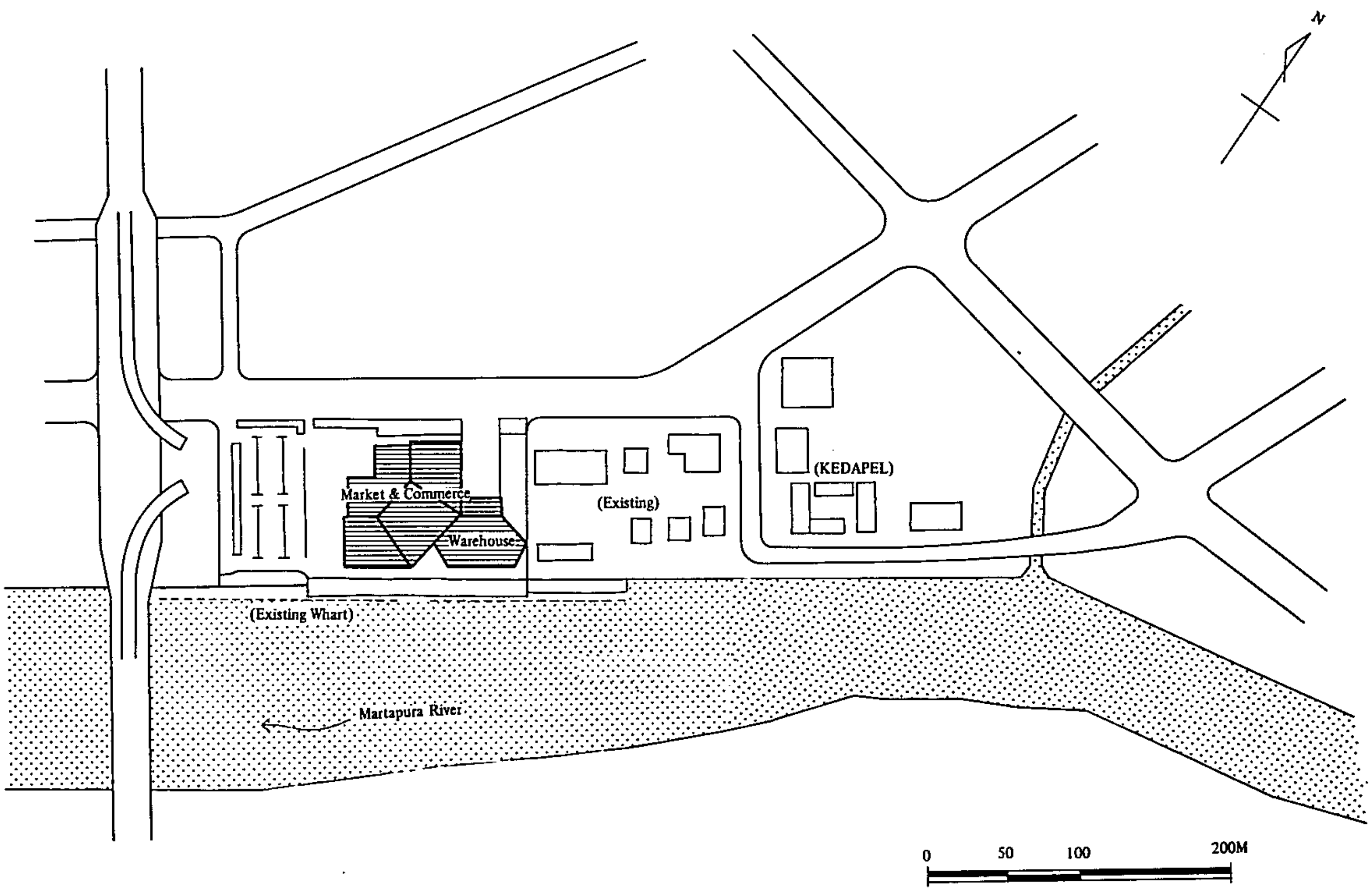


Fig. 5-19 Plan of the Redevelopment around the Martapura Wharf (1st phase 1990 - 1995)

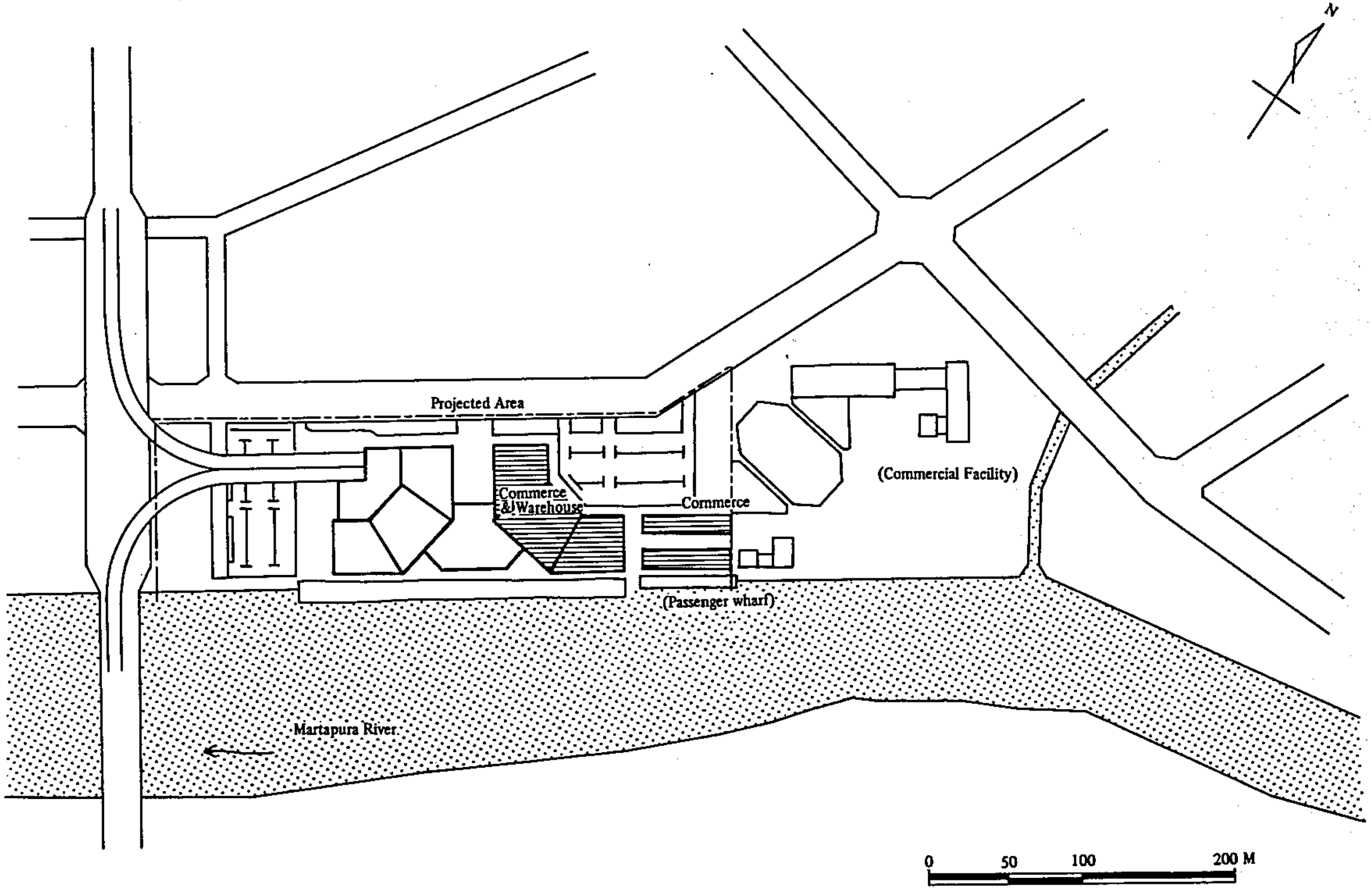


Fig. 5-20 Plan of the Development around the Martapura Wharf (2nd phase 1995 - 2000 A.D.)

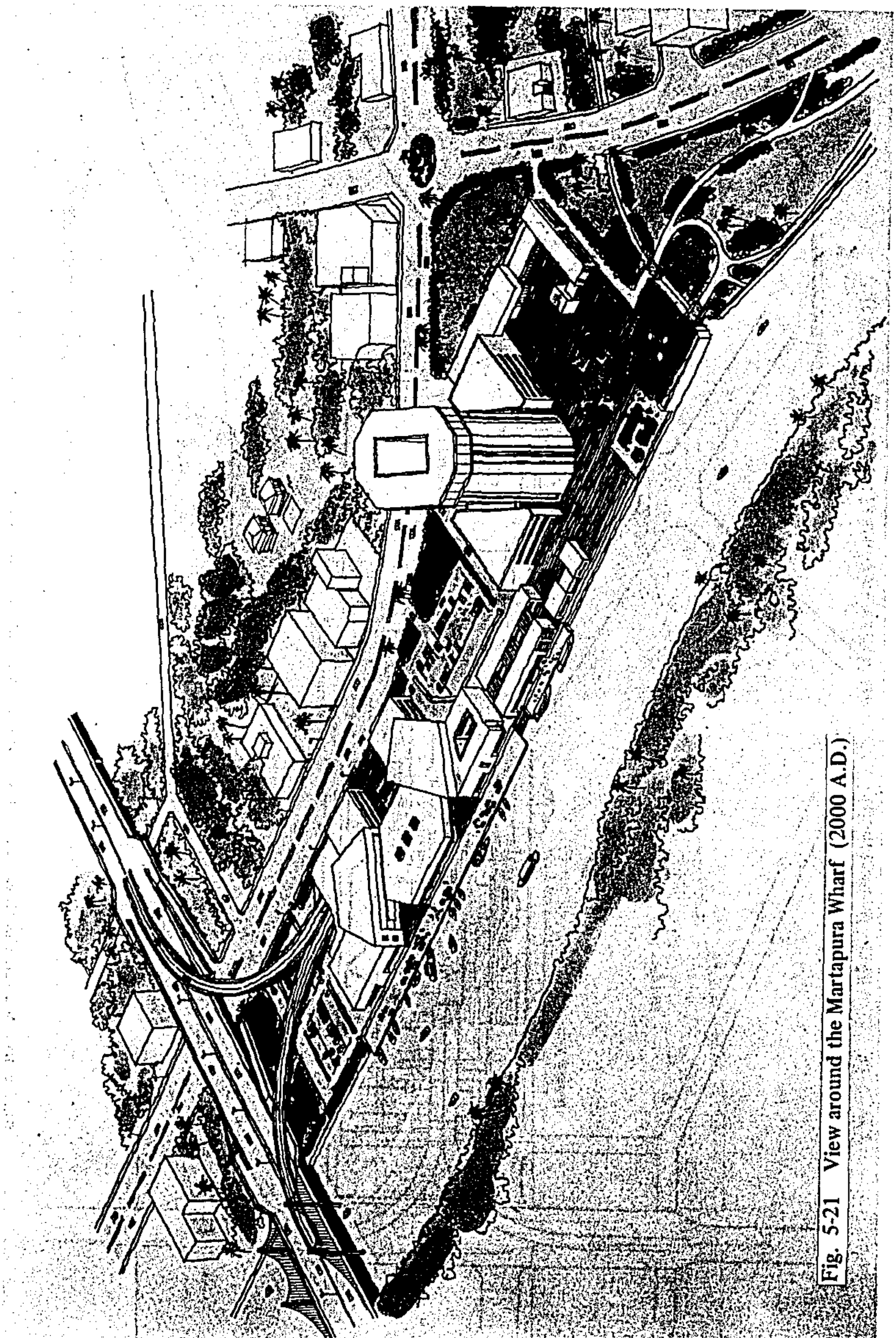


Fig. 5-21 View around the Martapura Wharf (2000 A.D.)

Chapter-6

Short Term Development Program (PLAN-I)

CHAPTER 6

SHORT TERM DEVELOPMENT PROGRAM (PLAN-I)

6-1. Introduction

6-1-1. This chapter describes the plans for Banjarmasin Port for 1983 which is assumed to correspond to the target year for PELITA III of Indonesia. These plans also correspond to the first stage of the plans for the year 2000 A.D. as explained in Chapter 5.

6-1-2. As determined in Chapter 3, the total amount of cargo estimated to be handled by the port of Banjarmasin in 1983 will be 2,810,000 tons.

As shown in Table 6-1, of this total volume, the cargo to be handled by the new wharf (including the existing Trisakti wharf) and Martapura wharf will be 750,000 tons, petroleum products handled by the dangerous cargo wharf (PERTAMINA's facility if continued in current condition) will be 290,000 tons and the logs and processed timber handled on the Barito River near Trisakti will amount to 1,770,000 tons. Although logs are currently being handled at the Taboneo anchorage, as a new channel has been dredged at the mouth of the river, it is believed that the lumber carriers will now select the calm waters of the river for cargo handling rather than the open sea at the mouth of the river. The installation of wharfs or jetties will therefore be unnecessary for cargo handling.

6-1-3. Martapura Wharf is currently in use as a special facility for sailing and local vessels and is principally used for discharging daily supplies.

As expalined in Paragraph 5-1, it is believed that this port will be consolidated in Trisakti area along the Barito River. However, as it has very close connections with the market place, it is presumed that it will be utilized as together with Trisakti Wharf by 1983. It is planned to transfer its function to the Trisakti area sometimes between 1984 and the year 2000 A.D. at such times when conditions in the improvement of connecting roads and that of the Trisakti Wharf will permit.

6-2. Present Situation of Banjarmasin Port

6-2-1. Banjarmasin Port is a river port located on the east bank of the Barito river approximately 30 km upstream.

In addition to being the capital of South Kalimantan State, Banjarmasin is also South Kalimantan's largest port facing the Java Sea. Although, a shallow sand bar extends out towards the Java Sea from the mouth of the Barito River making it difficult for large vessels to enter the port in the past, depending on the tide, large vessels of up to 8,000 DWT are now capable of entering the port as the channel has been extended

Table 6-1 Estimated Volume of Cargo to be handled at

Banjarmasin Port in 1983

Unit: 1000 tons

Kind of Cargo	Total Volume of Cargo		Place of Loading and Unloading						
			Wharf				Mooring Basin		Oil Terminal	
Exports	1,480		120		(120)		1,360			
Logs		1,000		1 -)		-		1,000		
Processed timber		360		-		-		360		
Rubber, Other Estate Crops		90		90		(90)		-		
Minerals		—		-		-		-		
Others		30		30		(30)		-		
Imports	70		70		(70)		-			
Outbound domestic	500		90		(90)		410			
Processed timber		410		-		-		410		
Others		90		90		(90)				
Inbound domestic	760		470		(420)		-		290	
Oil		290		—		—		-		290
Others		470		470		(420)		-		
Total	2,810		750		(700)		1,770		290	

Note: (   ) : equivalent general cargo volume approximately 14.5 km and has been dredged to depth of 6 meters in 1976.

The difference in tide levels in Banjarmasin Port is 2.5 m and the speed of the river current 1.5 m/sec at its maximum. Banjarmasin Port is located on a branch of the Barito River and is composed of 2 separate wharves. One of these is the Martapura Wharf which is an inland wharf situated on the west bank of the Martapura River flowing through Banjarmasin city and the other the Trisakti Wharf which is a comparatively new external wharf constructed in 1965 on the east bank of the main body of the Barito River.

The two wharves are approximately 3 km apart in a direct line and 8 km apart by water. Each has its own functions with Trisakti Wharf being used for berthing ocean going and interinsular vessels and Martapura for local vessels and sailing vessels.

In addition, a jetty for the PERTAMINA Petroleum Yard is located near the mouth of the Kuin River upstream from Trisakti Wharf and, in particular, there are also private jetties located at various places above Trisakti Wharf which are used principally for loading out lumber supplies.

6-2-2. Trisakti Wharf has quay for large vessels with a current water depth of 8 meters, a designed depth of 10 meters and an overall length of 200 meters. It is a piled type pier constructed of steel reinforced concrete floor slabs supported by concrete pillars 700mm in diameter. The width of the pier is approximately 60 meters with the front 15 m being the apron and shed, being the floor area of 6,000 m^2, provided on the rear 40 m. Therefore, as the river bed is used in its natural state and as the shed are provided on the pier, it is of stable construction and is not easily affected by floods or land settlement.

At the rear of the sheds, there is an unsurfaced open storage area of approximately 10,000 m^2.

Although there is a road connecting this pier to the city center, as it becomes considerably congested with normal traffic and as there is a wooden bridge in poor condition, one can hardly say that road conditions are sufficient.

Martapura Wharf has a quay for local vessels and sailing vessels and has an overall length of 348 meters, water depth of 4 meters and a designed depth of 7 meters. It is of a piled pier construction with wooden slabs supported by steel pillars of 125 mm diameter with threaded ends. It has a width of 10.5 meters and is also provided with 5 sheds about 9.0 m to the rear with an overall area of 5,000 m^2.

This wharf is located near the center of the city and although it is currently in use for discharging dialy supplies, cargo handling is impeded due to the deterioration of the port facilities. In addition, as the water area at the front is narrow and there is no leeway for expansion upstream or downstream, it is assumed that this wharf will lack the capability of handling increases in cargo volume from local vessels and sailing vessels in future.

In addition to the public facilities mentioned above, the private mooring facilities located along the east bank of Barito River are all simple wooden jetties used principally for mooring small sailing vessels etc. Further, there is a landing area for small boats adjacent to the market upstream from the Martapura Wharf where water buses connecting Banjarmasin city with the port service area and, though there are no statistics, it appears that considerable volume of traffic and cargo are being transported. It also appears that cargo handling is being carried out at times without using pier facilities such as the loading of logs at the Taboneo anchorage off the mouth of the Barito River and barge handling from ships anchored in waters in front of Trisakti Wharf.

6-2-3. The total number of ships that called Banjarmasin port in 1975 was 3,922 of which 252 were ocean going vessels, 382 interinsular vessels, 131 tankers, 624 local vessels and 2,533 sailing vessels. One feature of this port is the great number of sailing vessels resulting from the proximity of this port to the island of Java and to the ease in sailing the Barito River.

As shown in Table 6-2 the total of cargo handled at this port in 1975 was 1,185,000 tons of which 674,000 tons were foreign trade cargo and 511,000 tons domestic trade cargo. Foreign trade cargo consisted of 606,000 tons of log exports, 27,000 tons of rubber exports and 16,000 tons of processed timber exports while domestic cargo consisted mainly of 180,000 tons of timber outbound, 34,000 tons of sugar inbound, 15,000 tons of powdered cereals inbound and 12,000 tons of cement inbound etc.

In addition to the foregoing cargo, 10,800 tourists entered and departed from this port in 1975. If the handling of the foregoing cargo were classified by facilities, 28% of the general cargo was handled at Trisakti Wharf, 33% at Martapura Wharf and the balance of 39% at private facilities. Processed timber is the principal cargo handled at these private facilities. In addition, logs are handled at the Taboneo anchorage and petroleum at the PERTAMINA facilities.

Table 6-2 Volume of Cargo handled at Banjarmasin Port in 1975

Unit: 1000 tons

Kind of Cargo	Total Volume of Cargo	Place of Loading and Unloading			
		Wharf		Mooring Basin	Oil Terminal
Exports	657	44	(44)	613	
Logs	606	–		606	
Processed timber	16	9	(9)	7	
Rubber, Other Estate Crops	27	27	(27)		
Minerals	–	–			
Others	8	8	(8)		
Imports	17	17	(17)		
Outbound domestic	220	40	(40)		180
Processed timber	180	–			180
Others	40	40	(40)		
Inbound domestic	291	155	(155)		136
Oil	136	–			136
Others	155	155	(155)		
Total	1,185	256	(256)	613	316

Note: ( ): equivalent general cargo volume.

6-3. Access Channel

6-3-1. General

At the estuary of Barito River, sand bar, which is accumulated by sediment load and drift sand, has grown so that it interferes with the navigation of entering ships to the port of Banjarmasin. Dredging of the access channel to the port of Banjarmasin is commenced in 1975 and completed in October, 1976. The access channel is 14.3 Km in total length, 6 m in depth, 100 m in width and forms a generally linear way which, however, changes its direction slightly at the postiion 12.9 Km apart from the offshore end.

As is inevitable to an access channel positioned at a river mouth, continual dredging maintenance is necessary to keep its depth and, if left uncared, it has naturally the tendency to recovery the original configuration having the same depth as the circumferencial area.

Since the dredging works were commenced at the upper stream side, the downstream side of the access channel was blockaded during the dreding period, resulting in forming special and disadvantageous circumstances for the smooth waterflow, so that the access channel was silted with considerable amount of drift sand.

Siltation condition after the completion of dredging is determined by the regular sounding together with the comparison of its data. To establish the effective dredging scheme by utilizing its hydraulic characteristics, various site observations shall be patiently performed altogether. As to the siltation in the channel after the completion of dredging work, it is desiarable to refer the explanation in Chapter 4.

Maintenance of the dredged access channel is vital for the success of the developing scheme of Central and South Kalimantan.

Therefore, the determination of the quantity of the burial mud does not only facilitate programmed maintenance and control but also keeps the function of the port to the maximum, so that the development of the service area will be realized.

6-3-2. Hydraulic Condition

At the river mouth of Barito, the tidal range of spring tide is 2.9 m and diurnal tide is predominant. Monthly mean water level is lowest in August and highest in the rainy season. Duration period of ebb tide is approximately three quarters of a day and the maximum current speed at the river mouth exceeds 1.5 m/sec and the flow-direction is generally S - SW. Flood tide is smaller in both duration and current speed and generally directed to N - NW.

At the river mouth, although there eists salt wedge for only a few hours at the time of high tide in the rainy season, salt wedge of the dry season is not completely taken away from the river mouth even at the time of low tide.

With regard to soil quality, fine sand and extremely fragile silt are deposited by the thickness of 1 - 2 m from the surface layer at the river mouth side end of the access channel and the offshore end respectively, and are positioned on the lower silty fine sand layer having slightly more rigidity.

Wave has normally wave height of 0.2 - 0.5 m, wave period of 2 - 3 sec, and its scale and frequency become maximum in a year in the direction of S - SE at the time of south east monsoon in June through September. In the stormy weather the wave height becomes 1 - 1.5 m and the wave period, 4 - 5 sec, and the waves are broken on the outer bar.

In the north west monsoon season of December - February, it is recognized that the wave direction changes to W - SW and it stirs up mud in the shallow water, enters from the side area of the access channel and silts it.

Just behind the completion of work, in the nearshore half of the access channel, flowed-in mud is flushed by the tractive force of the river of Barito so that the depth of the river is ensured. We must pay attention persistently to the results of observations including the north-western monsoon season.

6-4. Depth of Channel

The depths of channel in 1983 were calculated according to the method taken for 2000, as shown in Table 6-3. In this case, the cargo load rate of ocean going liners is assumed to be 30%. In view of the present situation of Indonesia's trade, it is obvious that imports will greatly surpass exports in quantity of trade by liners. Indonesian liners will have general merchandise discharged for import, and have some general merchandise loaded for export at various ports of Java island. Then, they will have general merchandise loaded for export at Kalimantan, Sulawesi, etc. Therefore, the rate cargo loading rate will not exceed 30% at Banjarmasin.

Since different ship sizes from those of 2000 are forecast, respectively corresponding drafts are employed.

In 1983, after all, the required depth of channel is 2.9m for liners, 5.6m for timber vessels, and 2.9m for domestic travel vessels. Therefore, 6.0m as a round number is employed as the depth of channel in the planning.

Table 6-3 Calculation of Depth of Water of Access Channel (1983)

Kind of vessels	Ship size	Draft in full cargo	Cargo loading rate	Draft D_1	Expected sea level D_2	Keel clearance D_3	D $=D_1-D_2+D_3$
	DWT	m		m	m	m	m
Ocean going vessels							
Liners	10,000	8.3	0.3	4.6	2.0	0.3	2.9
Tramp vessels							
Timber	8,000	7.3	1.0	7.3	2.0	0.3	5.6
Domestic trade vessels							
General	2,000	5.1	1.0	5.1	1.0	0.3	4.4
Tankers	2,000	5.1	1.0	5.1	1.0	0.3	4.4

6-5. General Arrangement of Port Facilities

6-5-1. The basic facilities which are considered to be required by 1983 in the first-phase planning of the Master Plan in 2000 AD as shown in paragraph 5-6, 5-7, 5-9 are, as given in the following sections from paragraph 6-6 to paragraph 6-8, the wharf with a total length of 570 meters (including the existing wharf – 200 meters – at the Trisakti Wharf) for the ocean-going vessels and the interinsular vessels and the wharf with a total length of 818 meters (including the existing wharf – 348 meters – at the Martapura Wharf) for such small vessels as local boat, sailing vessels. In addition to them, 9 buoy berths are considered necessary for the cargo handling of logs and processed timbers at the river basin. (See Figs. 6-1, 6-2, 6-3).

6-5-2. The wharf for the ocean-going vessles and the interinsular vessels is to be extended 370 meters downstream from the existing Trisakti Wharf. In structure, the wharf is designed to have a –10m depth so that all the extension of 570 meters in this plan can be used for the ocean-going vessels in case that the wharf was extended further downward after 1984. Behind the wharf which will be built newly, transit sheds and open storage are arranged as with the existing wharfs. In order to carry out this expansion plan, the military area located downstream of the Trisakti Wharf must be transferred.

6-5-3. The wharf for the local vessels and the sailing vessels is now located at the Martapura Wharf. The wharf for the small vessels which will be required as the quantity of cargo goods increases from now onward is to be built newly in the Trisakti district.

The length of the new wharf which is to be built for small vessels by 1983 is calculated to be about 160 meters. Taking into account the smooth transfer of the cargo handling base for the small vessels from the Martapura district to the Trisakti district and the use of the wharf for the river boats and water buses, the 470 meters long, 4 meter design depth

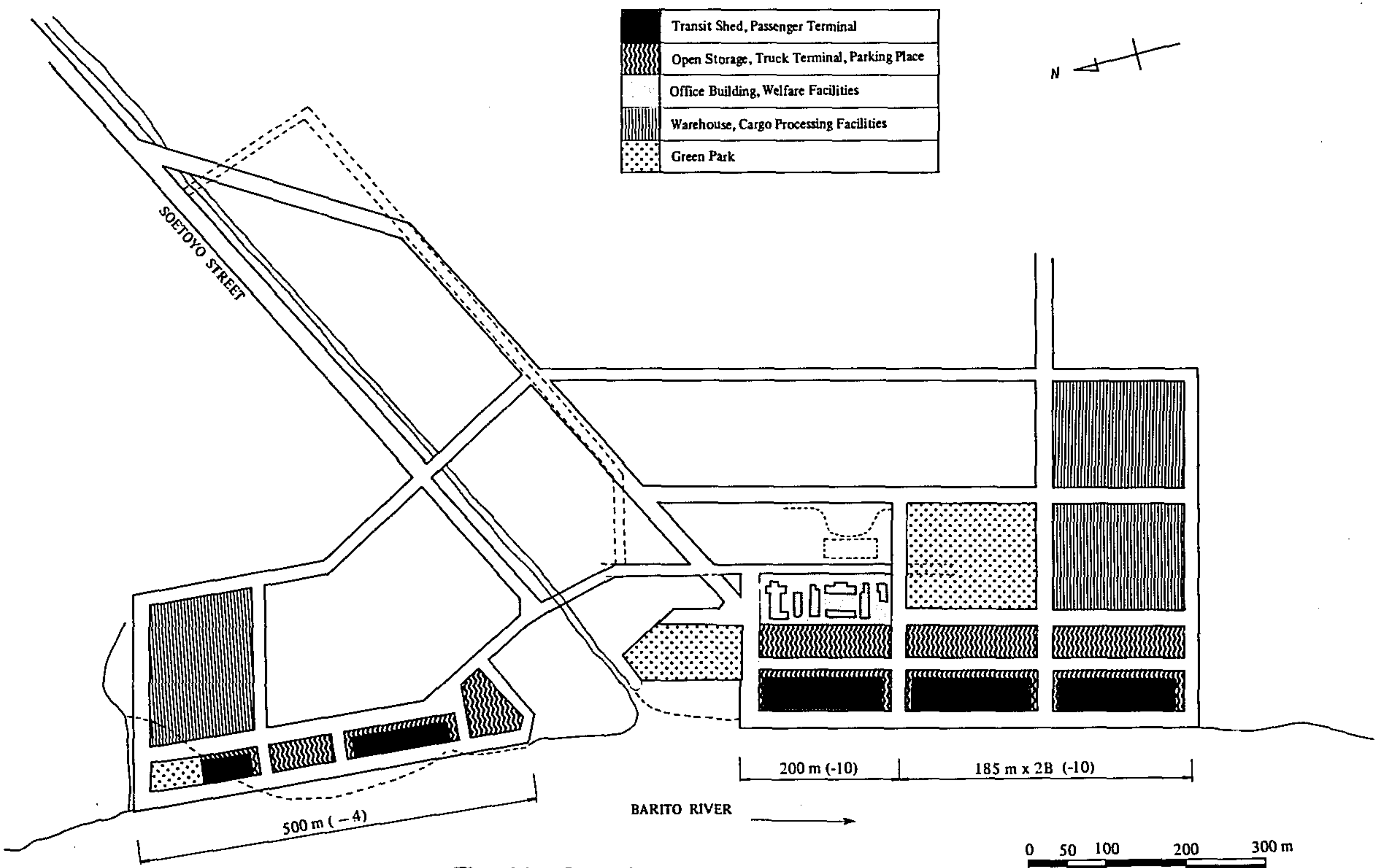


Fig. 6-1 Land Use Plan in Port Terminal Area in 1983

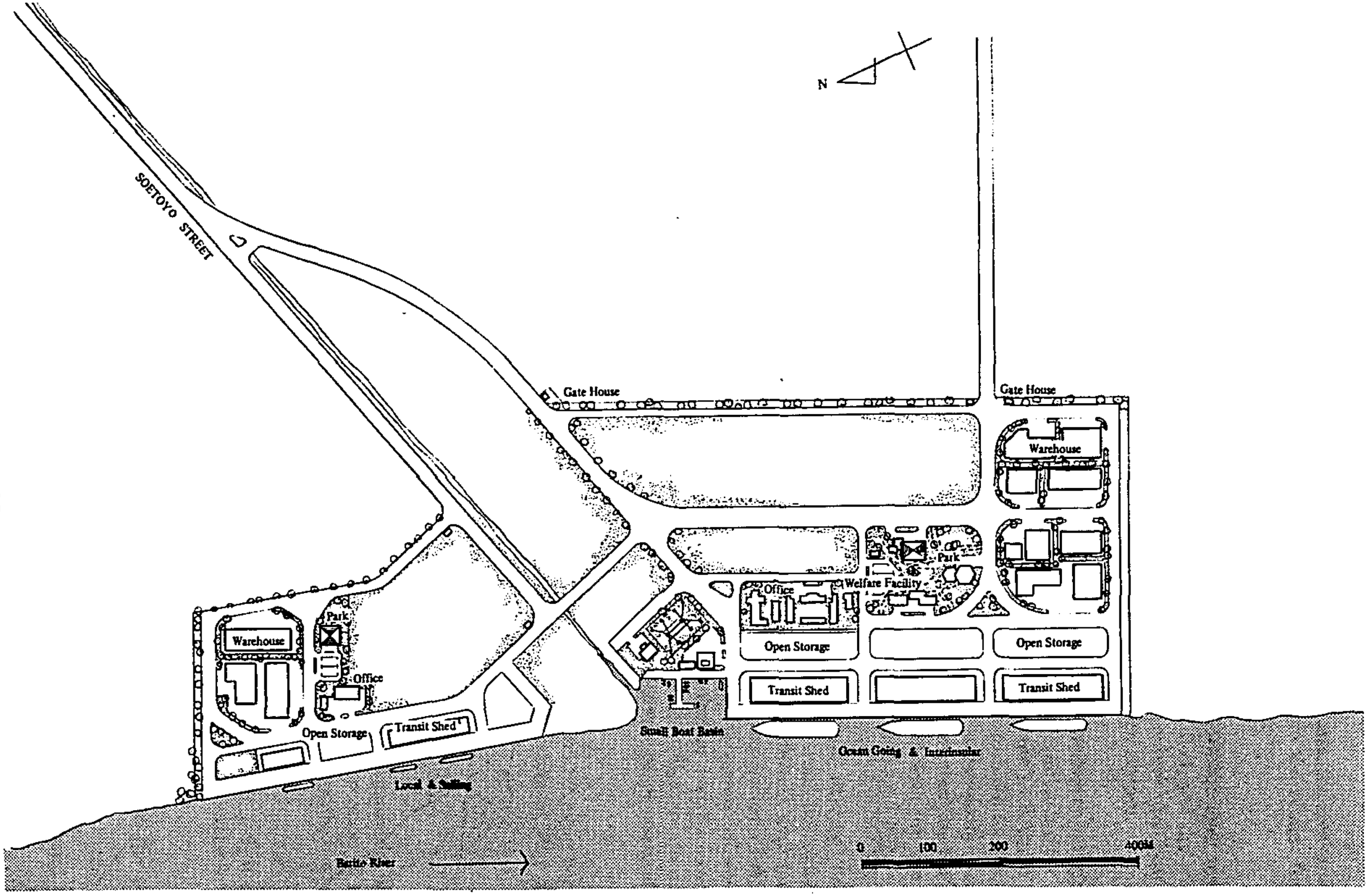


Fig. 6-2 Layout of Port Terminal Facilities (1983)

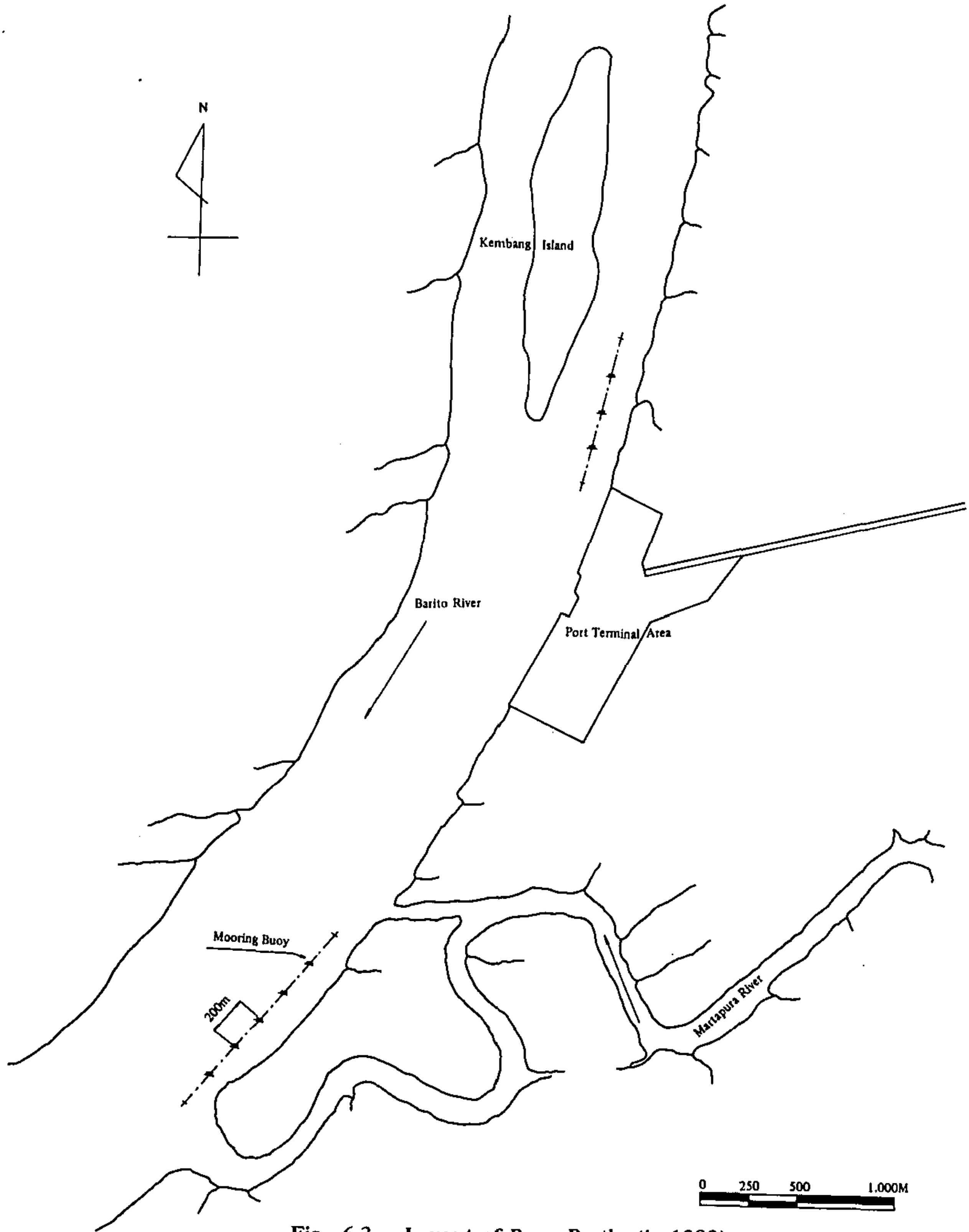


Fig. 6-3 Layout of Buoy Berths (in 1983)

wharf is to be built upstream of the Trisakti Wharf by 1983. In this case, the area close to the mouth of Tik Daram River which is reserved for the excavation in the nearest future in this plan cannot be used for this purpose.

In the Interim Report an excavated mooring basin was planned for the local vessels and sailing vessels by 1983. In this plan, however, the plan was modified, and the wharf is to be built along the banks of the Barito River so as to reduce the cost of construction. Behind the new wharf are arranged transit sheds and open storage.

6-5-4. As the cargo goods increase, the structure of physical distribution must be improved. From this point, it was assumed that there will be the requirement for the terminal warehouses. And, the site for them is to be secured behind the each wharf for the ocean-going vessels and the local and sailing vessels. It is possible to build in this site such factories for packing and labelling. Behind the wharf for the ocean-going vessels, another site for the expansion of the administration building and still another site for the transfer and building of the residence of the staff are arranged in parallel with the site for the warehouse.

The access to the wharf at this time has to depend upon the existing Teluk Dalam/Soetoyo road. Accordingly, an existing road which branches from the existing road, crosses Tik Dalam river and runs to Trisakti Wharf must be strengthened with much improvement, including the bridge over Tik Dalam river. Teluk Dalam/Soetoyo road is also utilized for the access to the wharf for the local and the sailing vessels. However, Improvement is required on one road and one bridge linking the former wharf area with the latter wharf area. This linking road and bridge are temporary ones which are destined to disappear when the dredging for the scheduled excavated mooring basin starts after 1984.

6-5-5. In addition to the above mooring facilities, it is necessary to build 9 buoy berths at a suitable place along the east bank of Barito River for the loading of logs and processed timbers to the ship.

6-6. Deep Sea General Cargo Berths

6-6-1. Observing transitions in the size of general cargo vessels in Banjarmasin port during the 7 year period from 1969 to 1975 from Table 6-4, the average sizes of the vessels range between 700 to 1,500 DWT and one cannot detect any trends towards further increases in size.

Observing the vessels in Surabaya Port during 1975 by type from Table 6-5, it can be noted that vessels for short-distance navigation averaged 1,570 DWT, and vessels for long-distance navigation averaged between 8,300 to 8,500 DWT.

It is believed that the general cargo vessels calling at Banjarmasin Port in the past were principally of the short-distance navigation type.

One reason that may be put forth for this phenomenon is that the shallow sand bar

Table 6-4 Transition of Scale of Ocean Going Vessels called at Banjarmasin Port (1969 - 1975)

Kind of Vessel	1969		1970		1971		1972		1973		1974		1975	
	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3
Ocean Going Vessels														
(1) General cargo	164	170,370	67	72,800	100	156,728	140	218,504	178	134,388	66	79,572	80	95,180
Average D.W.T.		1,040		1,090		1,570		1,560		755		1,210		1,190
(2) Log	–	–	36	143,087	105	545,890	157	877,420	206	1,323,500	155	1,062,469	172	1,008,949
Average D.W.T.		–		3,970		5,200		5,590		6,420		6,854		5,870
(3) Oil	52	63,256	55	78,247	154	193,240	228	254,470	325	255,618	123	69,545	131	66,114
Average D.W.T.		1,220		1,420		1,250		1,120		787		565		505

Note: This figure is on the bases of "DATA² ANGKUTAN-LAUT, PELABUHAN B'MASIN, TAHUN 1969 - 1975 DST."

Table 6-5 Scale of Vessels called at Surabaya Port in 1975

Kind of vessel	Number of vessels	D.W.T.	Average D.W.T./M^3
1. Ocean Going vessels			
(1) National vessels	182	1,548,031	8,510
(2) Foreign vessels	844	7,051,139	8,350
(3) Vessels for short-distance navigation	142	223,008	1,570
(4) Average	1,168	8,822,178	7,550
2. Interinsular vessels	1,314	1,799,284	1,370
3. Local vessels	3,188	438,580	140
4. Sailing vessels	2,019	238,407	120

Note: This figure is on the bases of "DATA² STATISTIK PELABUHAN SURABAYA TH. 1975" at the mouth of the Barito River obstructed passage of larger vessels. However, as a 6 meter deep channel has been dredged through this sand bar in 1976, it is believed that ships of the average size that called at Surabaya Port in 1975 will be capable of entering the port by waiting for high tide. From the restrictive conditions of the water depth, deep sea general cargo berths for vessels up to 8,000 DWT (7.8 draft fully loaded) may be considered. As explained in Paragraph 5-2, since no great difference in costs should arise due to the depth of the water and the soil conditions at the site of the planned pier construction, it was decided to construct a 10 meter deep quay (for 15,000 DWT) from the structural design and it was felt that it would be suitable to deepen the area in front of the pier at a later date when the need arose.

6-6-2. The quantity of the general cargo handled at the wharf in 1975 was 584 tons/meter of the wharf. Since the wharf is shared with the interinsular vessels, the wharf is not yet operated to 100% capacity. The method of cargo handling based on 7 working hours/day/gang is almost close to the manual cargo handling. If the cargo handling method was mechanized, the cargo handling capacity will further increase even though the quantity of the general cargo increased. Under this situation, more room for the cargo handling is expected.

In Table 5-22 are shown the actual figures of the cargo handling capacity at Banjarmasin port and other major ports of Indonesia and also the target figures in PELITA II. According to the table, it is known that the actual figures were more than 900 tons/meter of cargo handling capacity at Surabaya port and Tg. Priok Port, respectively in 1975 and 1974. Since the upper limit to the cargo handling capacity as a target in PELITA II is set at 900 tons/meter, the cargo handling capacity at the ocean-going vessels wharf in 1983 is assumed to be 900 tons/meter.

Meanwhile, since the quantity of the foreign trade cargo to be handled at the wharf in 1983 is assumed to be 190,000 tons from Table 6-1, the extension of the required wharf is calculated to be about 210 meters. It is known from the calculation that the foreign trade cargo can be almost handled at the existing Trisakti Wharf being 200 meters long.

6-6-3. The 190,000 tons of the foreign trade general cargo in 1983 can be broken down into 70,000 tons of imports and 120,000 tons of exports. The exports are made up mainly of rubber.

Estimation of the flow of these cargoes based on the actual figures at Banjarmasin port and major Japanese ports is given in Table 6-6. The standard service facilities required for the flow are shown in Table 6-7.

6-7. Regional Harbour Facilites

6-7-1. Vessels that are to be accommodated by the regional harbour facilities are interinsular vessels, local vessels, sailing vessels and small crafts such as water buses and river boats etc. used for transportation by water to the port service areas at the back.

Table 6-6 Estimated Foreign Trade Cargo Flow at the Wharf in 1983

Unit: 1000 tons

Kind of Cargo	Cargo to be handled at the Wharf	Cargo Flow		
		Transit Shed	Open Storage	Direct Transport to/from Hinterland
1) Export	120	113	3	4
Logs	–	–	–	–
Processed timber	–	–	–	–
Rubber, Other estate crops	90	90	–	–
Minerals	–	–	–	–
Others	30	23	3	4
2) Import	70	14	32	24
Total	190	127	35	28

Table 6-7 Required Area for Major Cargo Distribution Facilities for Foreign Trade in 1983

Facilities	Area (m^2)	Remarks
1. Transit Shed	8,800	Indicates the floor area for the transit shed. In addition to one existing transit shed, one transit shed, (150m x 40m) is to be built.
2. Open Storage	4,200	Indicates the paved area for cargo distribution and temporary cargo storage.
3. Warehouse	6,000	Indicates the floor area for the warehouse.

Note 1: The required area for the transit shed was calculated on the basis that the quantity of cargo storage per unit area is 2.0 t/m^2; the rotation is 12 times per year; and the cargo storage ration is 0.6.

Note 2: The required area for the open storage was calculated on the basis that the quantity of cargo storage per unit area is 2.0 t/m^2; and the rotation is 6 times per year; and the cargo storage ratio is 0.7.

Note 3: The required area for the warehouse was calculated on the basis that the quantity of cargo storage per unit area is 2.0 t/m^2; the rotation is 6 times per year; and the cargo storage ratio is 0.6.

Observing transitions in the above types of vessels in Banjarmasin Port for the 7-year period from 1969 to 1975 from Table 6-8, it may be noted that both R.L.S. and non R.L.S. type interinsular vessels followed an increasing trend and had reached an average of 800 DWT in 1975. On one hand, observing the types of interinsular vessels calling at Surabaya Port during 1975 from Table 6-5, it may be noted that the average size is 1,400 DWT. From the foregoing it may be assumed that interinsular vessels may attain 3,000 DWT.

Similarly, we will assume that local vessels and sailing vessels will be 300 DWT.

In relation to small crafts such as water buses and riverboats employed to connect the port with the port service areas at the back, a water depth of 2 meters is considered sufficient for the mooring facilities due to the water depths in the various canals such as Serapat, Kelampan etc.

6-7-2. Transitions in ship tonnage and share of the various domestic types mentioned above (excluding small crafts such as water buses, river boats etc.) that have called at Banjarmasin Port during the 7 year period from 1969 to 1975 are shown in Table 6-9. If the shares of the tonnage of the various types of domestic vessels for 1983 were graphically estimated utilizing these trends, as shown in Figure 6-4, it will be assumed that interinsular vessels would increase to 40%, local vessels to 25% and sailing vessels would decrease to 35%.

On one hand, as the cargo load per DWT by type of domestic vessel for the period of 1967 to 1975 averaged 0.751 tons for interinsular vessels, 0.471 tons for local vessels and 0.506 tons for sailing vessels, if we take these figures and calculate the amount of cargo that will be handled in 1983 by each type of domestic vessel, it is estimated that interinsular vessels will handle 50%, local vessels 20% and sailing vessels 30%.

6-7-3. The quantity of the general cargo handled at the wharf in 1975 was 584 tons/meter for the Trisakti Wharf and 474 tons/meter for the Martapura Wharf.

The cargo handling capacity at the Trisakti Warf still has more room for further increase in capacity as described in paragraph 6-6-2. On the other hand, at the Martapura Wharf, the traffic is so heavy, and the facilities are old, and the mechanization of cargo handling seems difficult. Accordingly, the above figure is assumed to be nearly the full-capacity figure. However, at the new wharf which will be built, improvement on the capacity of cargo handling will be made due to the mechanization of cargo handling.

Table 5-25 shows the actual figures of the cargo handling capacity at Banjarmasin port and other major ports of Indonesia and the target figures in PELITA II. From the table, the actual figure for the interinsular vessels wharf is known to be 672 tons/meter at Tg. Priok port, and the figure at Surabaya port is known to be 553 tons/meter which is slightly lower than that at the Trisakti Wharf.

Based on the above figures, the cargo handling capacity at the interinsular vessels wharf is assumed to be 700 tons/meter in 1983.

Table 6-8 Transition of Scale of Interinsular, Local and Sailing Vessels called at Banjarmasin Port (1969 - 1975)

Kind of Vessel	1969		1970		1971		1972		1973		1974		1975	
	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3	No. of Vessels	DWT/M^3
1) Interinsular vessels														
(1) R.L.S.	132	20,113	180	30,092	150	46,808	130	71,610	347	112,656	213	121,650	131	176,483
Average D.W.T.		152		167		312		551		325		571		567
(2) Non R.L.S.	303	27,502	354	61,000	403	90,000	589	160,612	432	106,000	193	52,766	71	57,923
Average D.W.T.		91		172		223		273		245		273		816
2) Local vessels	215	6,611	124	5,134	236	11,187	834	46,944	1,337	103,094	634	135,704	624	158,291
Average D.W.T.		31		41		47		56		77		214		254
3) Sailing vessels	1,999	221,066	2,268	282,407	2,128	305,983	2,369	304,696	2,885	500,171	2,369 (1,273)	321,203 (97,259)	2,533 (1,232)	451,756 (86,033)
Average D.W.T.		111		125		144		129		173		136 (76)		178 (70)

Notes: (1) ( ): for sailing vessels with engine

(2) This figure is on the bases of "DATA[2] ANGKUTAN-LAUT, PELABUHAN B'MASIN, TAHUN 1969 - 1975 DST."

Table 6-9 Share of Ship Tonnage by Kind of Vessels, Banjarmasin Port (1969 - 1975)

Year	Domestic Trade										Grand Total
	Interinsular						Local		Sailing		
	R.L.S.		Non R.L.S.		Total						
	D.W.T./M^3	Share	D.W.T./M^3	Share	D.W.T./M^3	Share	D.W.T./M^3	Share	D.W.T./M^3	Share	D.W.T./M^3
1969	20,113	7.3%	27,502	10.0%	47,615	17.3%	6,611	2.4%	221,066	80.3%	275,292
1970	30,092	7.9	61,000	16.1	91,092	24.0	5,134	1.4	282,407	74.6	378,633
1971	46,808	10.3	90,000	19.8	136,808	30.1	11,187	2.5	305,983	67.4	453,978
1972	71,610	12.3	160,612	27.5	232,222	39.8	46,944	8.0	304,696	52.2	583,862
1973	112,656	13.7	106,000	12.9	218,656	26.6	103,094	12.5	500,171	60.9	821,921
1974	121,650	19.3	52,766	8.4	174,416	27.7	135,704	21.5	321,203	50.9	631,323
1975	176,483	20.9	57,923	6.9	234,406	27.8	158,291	18.7	451,756	53.5	844,453
1969 - 1975	579,412	14.5	555,803	13.9	1,135,215	28.4	466,965	11.7	2,387,282	59.8	3,989,462

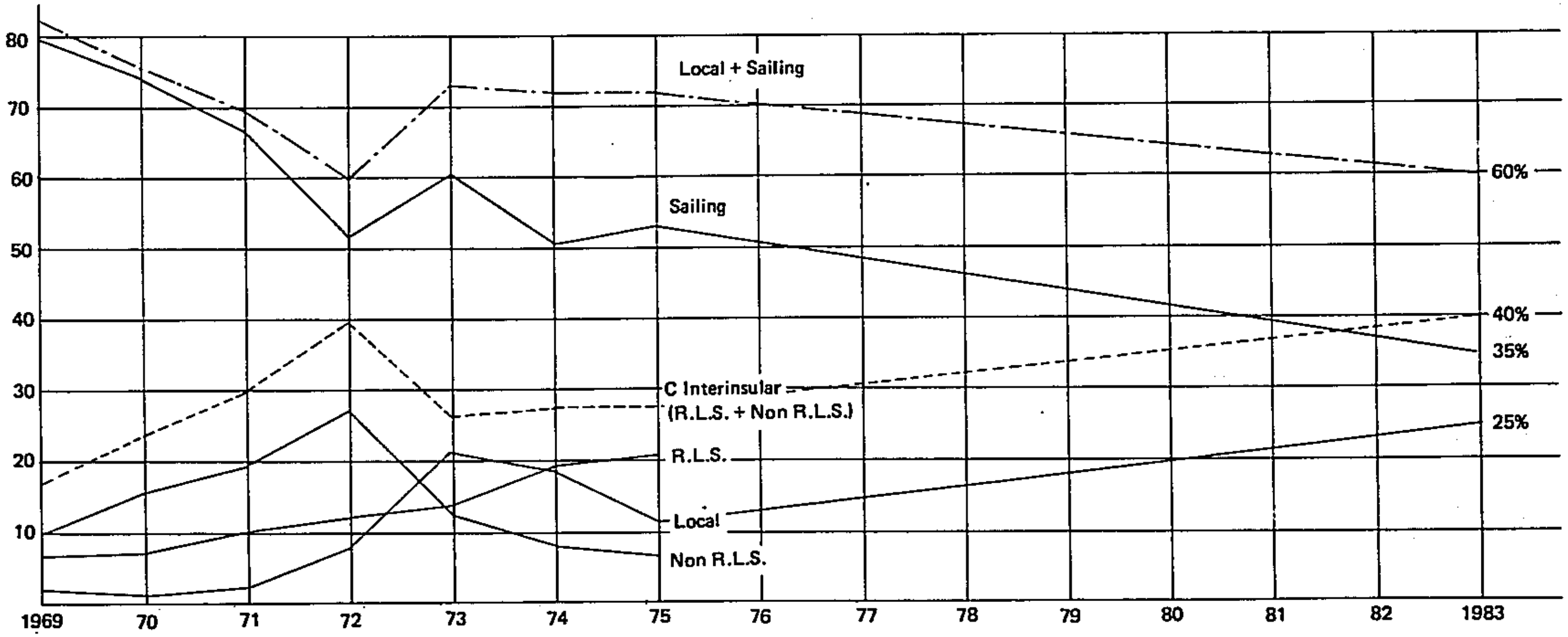


Fig. 6-4 Share of Ship Tonnage by Kind of Vessels, Banjamasin Port (1969 – 1975)

Meanwhile, looking at the cargo handling capacity at the local & sailing vessels wharfs, Sunda Kelapa port shows the highest figure of 590 tons/meter whereas Surabaya port shows an extremely low figure of 164 tons/meter. This is because the ships are moored slantwise to the wharf at Sunda Kelapa port to make the best use of the wharf extension on one hand, whereas, at Surabaya port, the mooring facilities are built in an extremely long distance along Kalimas river, offering more sufficient facilities in comparison with the cargoes. Based on the above study, the cargo handling capacity at the local & sailing vessels wharf is assumed to be 500 tons/meter in 1983.

It is known from Table 6-1 that the quantity of the domestic trade cargo to be handled at the wharf in 1983 is 560,000 tons and that the conversion of this quantity to the general cargo gives a value of 510,000 tOns. If an assumption is made as studied in paragraph 6-7-2 that 1/2 of the general cargo is handled at the interinsular vessels wharf while the remaining 1/2 at the local & sailing vessels wharf, the extension of the required wharf is 360 meters for the former while 510 meters from the latter. The required wharf length for the domestic trade cargo and the foreign trade cargo combined is shown in Table 6-10.

An extension of 370 meters – two berths each measuring 185 meters – is to be built on the downstream side of the existing Trisakti Wharf (200 meters). The extension is for the interinsular vessels wharf. The extension is to be made from the existing Trisaki Wharf (200 meters) so that the new extension can be used also for the ocean-going vessels in the future. However, for the time being, the total extension of 570 meters including the existing wharf may be used for both the interinsular and the ocean-going vessels.

If the existing 348-meter Martapura Wharf is assumed to be utilized as it is, additional extension is calculated to be 160 meters. However, this is modified to 470 meters with some room allowed as described in paragraph 6-5-3. This wharf is to be built along the banks of Barito river on the upstream side of the Trisakti Wharf.

6-7-4. The 560,000 tons of the domestic trade cargo to be handled at the wharf in 1983 can be broken down into 470,000 tons of inbound domestic trade and 90,000 tons of outbound domestic trade.

Estimation of the flow of these cargoes based on the actual figures at Banjarmasin port and major Japanese ports is given in Table 6-11. The standard service facilities required for the flow are in Table 6-12.

6-7-5. Fig. 6-5 shows the basic cross-sectional views of various wharfs. The 370-meter long and 10-meter deep wharf to be built in connection to the existing wharf of the Trisakti Wharf is intended for the future use exclusively of the ocean-going vessels. Because of the substantially poor soil conditions, no need for giving consideration to the earhtquake, and flow of the river, the piled wharf structure is judged to be suitable for the new wharf.

The existing Trisakti Wharf is also of the piled wharf structure. But, here, a transit shed of a length of 150 meters and a width of 40 meters is carried on the wharf, so that the piled

Table 6-10 Required Quay Length in 1983

Unit: m

Kind of Quay	1975	1983	Remarks
Quay for Ocean Going Vessels	200	570	Existing 200m x 1 berth (Trisakti Wharf)
Quay for Interinsular Vessels			New establishment 185m x 2 berths
Quay for Local and Sailing Vessels	348	818	Existing 348m (Martapura Wharf) New establishment 470 m (Considering river boats, water buses etc. mooring 470 meters to be built)

Table 6-11 Estimated Domestic Trade Cargo Flow at the Wharf in 1983

Unit: 1000 tons

Kind of Cargo	Cargo to be handled at the Wharf		Cargo Flow: Transit Shed		Cargo Flow: Open Storage		Cargo Flow: Direct Transport to/from Hinterland	
1) Outbound domestic	90		30		34		26	
Processed timber		–		–		–		–
Others		90		30		34		26
2) Inbound domestic	470	18	188		47		235	
Oil		–		–		–		–
Others		470		188		47		235
Total	560		218		81		261	

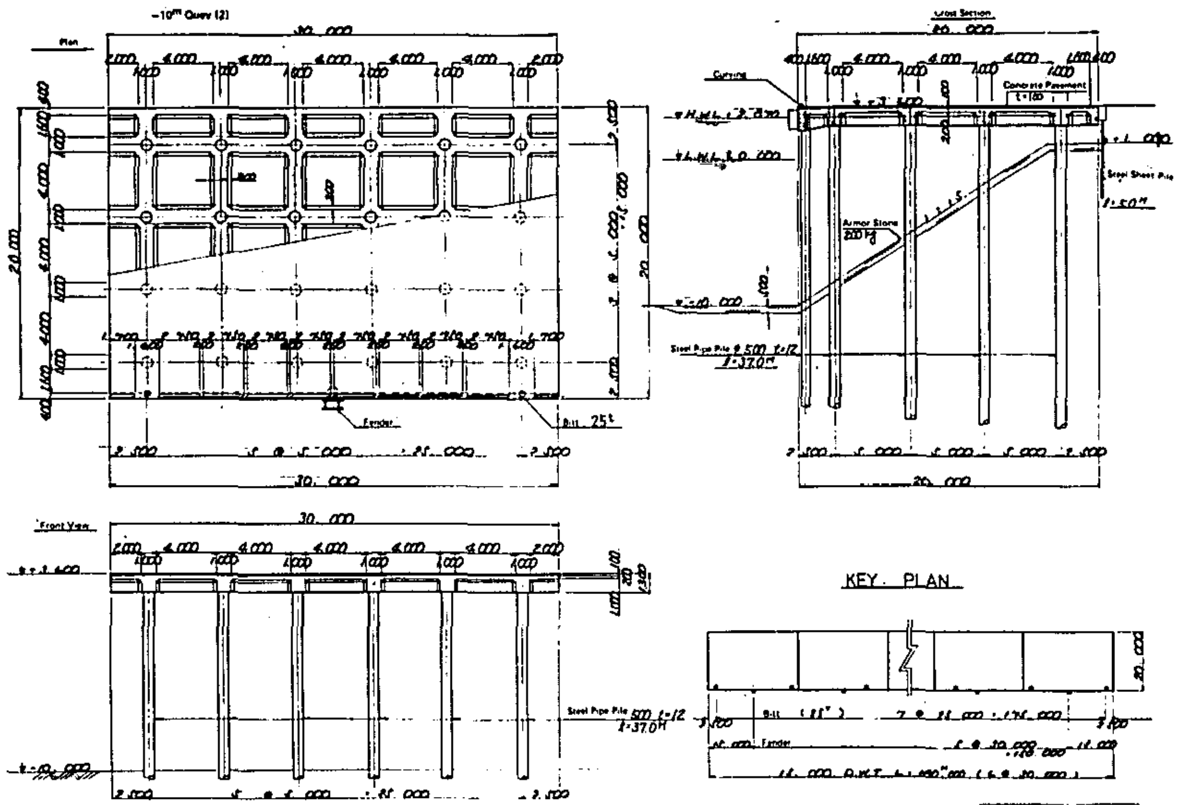
Table 6-12 Required Area for Major Cargo Distribution Faclities for Domestic Trade in 1983

Facilities	Area (m^2)	Remarks
1. Transit Shed	15,200	Indicates the floor area for the transit shed.
Interinsular	7,600	One to transit shed, (150m x 40m), is to be built.
Local & Sailing	7,600	One and half transit shed, (125m x 25m, and 62.5m x 25m, is to be built.
2. Open Storage	9,800	Indicates the paved area for cargo distribution and temporary cargo storage.
Interinsular	4,900	
Local & Sailing	4,900	
3. Warehouse	13,900	Indicates the floor area for the warehouse.

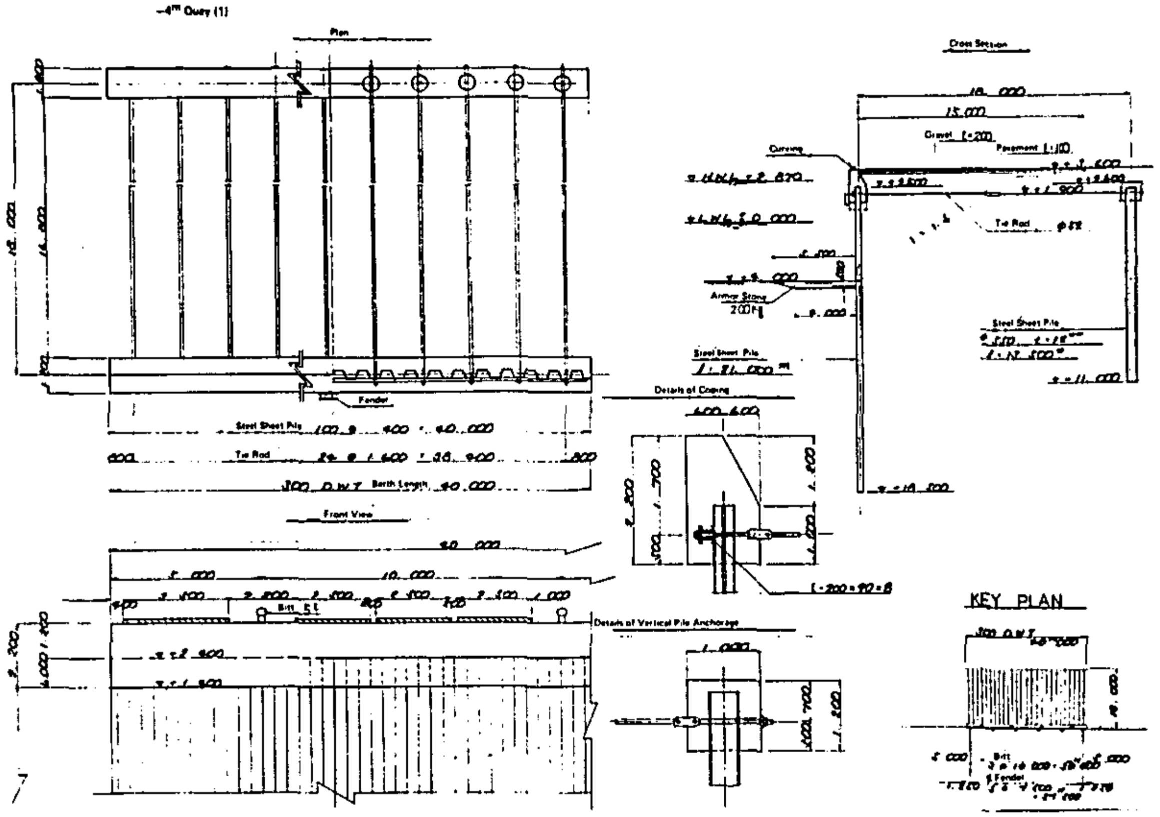
Note 1: The required area for the Transit shed was calculated on the basis that the quantity of cargo storage per unit area is 2.0t/m^2; the rotation is 12 times per year; and the cargo storage ratio is 0.6.

Note 2: The required area for the open storage was calculated on the basis that the quantity of cargo storage per unit area is 2.0 t/m^2; the rotation is 6 times per year; and the cargo storage ratio is 0.7.

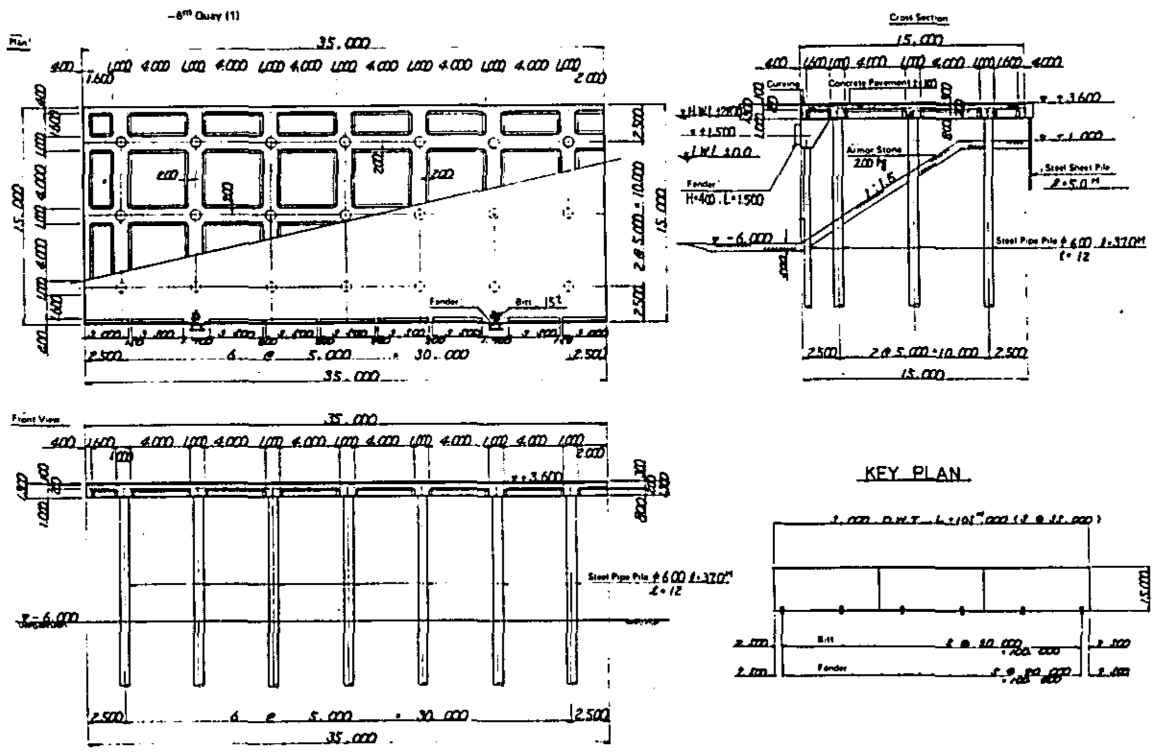
Note 3: The required area for the warehouse was calculated on the basis that the quantity of cargo storage per unit area is 2.0 t/m^2; the rotation is 6 times per year; and the cargo storage ratio is 0.6.



-10^m Quay



-4^m Quay



-6^m Quay

Fig. 6-5 Structural Plan of Quay

wharf is as wide as 60 meters and is expensive in structure. For the new wharf, a 20-meter wide apron is considered sufficient even if consideration is given to the mechanization of cargo handling by means of fork lifts. Therefore, if the width of the new wharf is limited to 20 meters and if the revetment is made with stone piching and sheet piles, the new wharf will become a more economical structure. In the comparative design, the use of steel pipe piles as the legs of the piled wharf was compared with the use of concrete piles. As long as a plant to produce concrete piles is not built in Banjarmasin, the use of steel pipe piles is more economical.

With regard to the local & the sailing vessels wharf which is designed to be 4 meters deep, sheet pile structure is judged to be suitable under the condition that it is to be built along the excavated mooring basin. With regard to the 4-meter deep wharf which is to be built along the Barito River, the same structure is assumed for the purpose of cost estimation of the construction work. However, taking into account the depth distribution along the banks of the Barito river, it is necessary to give reconsideration to the structure only at this point. In the comparative design, the use of the sheet piles was compared with the use of concrete piles, and, for anchoring, the vertical pile system was compared with the slant pile system. Because of the poor soil conditions, the structure using sheet piles for main structure and steel pipe piles as vertical anchor piles is the most economical.

6-8. Log and Timber Loading Basin

6-8-1. The quantity of logs and processed timbers expected to be handled at Banjarmasin port in 1983 is, as shown in Table 6-1, 1,000,000 tons of logs and 770,000 tons of processed timber respectively, with the domestic trade cargo and the foreign trade cargo combined.

The logs are now being loaded at the Tabaneo anchorage off the estuary of the Barito River. Now that the access channel at the estuary of the Barito River is completed, ships with drafts lower than 6 meters can enter the basin any time. Even the special lumber carriers weighting up to about 8,000 DWT can enter the basin if they wait for the tide. So, all of the ships can load the logs in the calm Banjarmasin port. Since the logs arrive in rafts and are loading directly from the logs loading basin established at Barito River there is no need for a wharf.

Meanwhile, the processed timbers like lumbers, plywood, are assumed to be handled not at the wharf but by means of the barges which carry the processed timbers to the ships and load them onto the ships. Based on the assumption, the amount of processed timbers to be handled in the basin is set at 770,000 tons. Assuming that the cargo handling capacity for one berth is assumed to be 200,000 ton per year, 9 buoy berths are necessary.

6-8-2. Near Banjarmasin city along the Barito River, the maximum current velocity is on the order of 1.5m/sec, and the direction of the flow reversed, depending upon the tidal change. Accordingly, if one point mooring system is used, the ship swings around the buoy or the anchor, resulting in the hindrance of the navigation of the other ships. This also causes inconvenience in cargo handling. Therefore, two point mooring system is recommended. In this case, if the continuous berths are to be built along the bank of the Barito River and if both ends of the berths are to be moored by ship's own anchors, less buoys will do the purpose. As the depth along the west bank of the Barito River is shallow, it is better to install the buoys, as shown in Fig. 6-3, upstream of the Trisakti Wharf or along the east bank downstream of the Martapura Short Cut.

Since the logs can be stocked in raft form, the raft mooring system as is frequently seen near the Banjarmasin port will do along the west bank of the Barito River in front of Trisakti Wharf or along the beach of the Kembang island. For the time being, there is no requirement for the facility to stock the logs. However, from the point of preventing the loss due to floods or from the point of control, simple mooring posts made by wooden piles or concrete piles, should be installed for the rafts to mooring.

6-8-3. Lumber is currently felled in the upper reaches of the Kapuas and Kahayan River rather than the Barito River and is formed into rafts and floated downstream. It will therefore be highly desirable to improve the canals connecting these rivers to carry out smooth transportation of the logs to Banjarmasin Port. Not only will improvement of these waterways aid in the transportation of lumber but they will also be of assistance in shipping out farm products from the service area and also in receiving daily supplies.

There are currently portions of the canal where the water depths falls below 1 meter during the dry period at low tides and is in such condition that not only is it difficult to transport rafts but is even difficult for small crafts such as water buses and river boats. It will therefore be necessary to initially deepen the central portion of the shallow waterways to approximately 2 meters.

As unlimited increases in felling trees cannot be considered from the viewpoint of preserving natural resources, after deepening the waterway, increasing trends in normal water traffic should be observed and when it appears necessary to do so, to widen the canals.

6-9. Industrial Area

Fifty percent of the industrial shipments estimated in 1983 in the service area of Banjarmasin Port is presumed to be provided by the industries located in Banjarmasin city and the areas adjacent to it.

The industrial area and workers necessary for the scale are estimated as shown in Table 6-13.

In selecting industrial area, the following matters were taken into consideration.

(1) Characteristics of the types of industries to be located in future

In 1983, sawing and timber processing industries will be the main kind of the industries located Banjarmasin. There is large possibility that these types of industries with forest resources as the raw materials will remain to be located at the riversides of the Barito River and the riversides of tributaries directly connected with the Barito River.

(2) Expansion of the urban areas in future and the outlook for land utilization

The selection of industrial area should be done with consideration on the expansion of residential area in future and the outlook for the land utilization in Banjarmasin city and the peripheral areas.

A proper balance is considered in the land utilization on the riversides of the Barito river mainly for the port, parks and green zones.

(3) Extension plan of port facilities in future

To be able to meet the extension of port facilities in future, utilization is reserved on the riversides below the present Trisakti wharf to the mouth of the Martapura river.

(4) Present land utilization

With regard to the present distribution, of factories, most factories are located along the Barito River, being engaged in power sawing, plywood production, etc. On the other hand, around Martapura wharf small-scale factories are located for rotan processing and sawing by man power. Many small-scale manual saw mills are located along the upper reaches of the Kwin river. On the upstream riversides of the Trisakti wharf, to face the Kembang island, there is much land left unused, and it is desirable to plan the use of it as a park and green zone for the citizens to see and enjoy the port and to face the Barito river.

From these considerations, it is desirable to secure the industrial area from the site of upstream of the Trisakti wharf and around the Kwin river by 1983, and to promote the industrialization for the time being, using the land. The land utilization plan for the area in and around the port is as shown in Fig. 6-6.

6-10. Maintenance Dredging and Navigational Aids

6-10-1. In this report, the annual maintenance dredging volume in the future is estimated at 2,600,000 m^3 after the completion of dredging with water depth of −6.0 m along the access channel at the estuary of Barito River, this being the mere temporary estimation based upon the limited materials of investigation, it is recommended that the plan for the future maintenance dredging shall be decided upon at least at the lapse of one year after the completion of dredging of the access channel.

It is suitable to apply the trailing suction hopper dredger for the maintenance dredging, which shall remove the thin layers of mud and silt that were segmented along the channel. Suppose with trailing suction hopper dredger with hopper capacity of 750 m^3, same type of "Rombok" if applied, 60% of the hopper capacity being the effective dredging volume, it would be possible to dredge 450 m^3, per one cycle. Taking for instance, dredging volume be as 2,600,000 m^3, yearly working days be as 200 days, the number of cycles per day that is necessary for dredging and disposal of the mud shall be of 30 rotations.

Table 6-13 Land for Industrial Use Around the Banjarmasin Port (in 1983)

	Types of Industries	Production Scale (x 1000 ton)	Shipping Amount (million US$)	Site Area (ha)	Workers Number (x 1000 persons)	Remarks	Site Area for Industrial Use including Green Zone and Road (ha)
Industries to be an object of export or shipment	Lumber Processing	405	58	105	11	Sawing, Plywood	
	Rubber Processing	20	8	10	1	Crumb Rubber	
	Livestock, Fish Processing	-	-	-	-		
	Others	10	3	5	1	Rotan Processing and other handicraft	180
Industries to be an object of import or shipping in	Cement and Secondary Products	-	-	-	-		
	Assembling and Repairing of Machinery	8	4	5	1	Repair of Agricultural Machinery	
	Others	-	13	45	5		70
	Sub-Total	-	82	170	18		
	Green Zone/Road	-	-	80	-		(80)
	Total	-	82	250	18		250

Note: Shipping amount is based on 1975 price

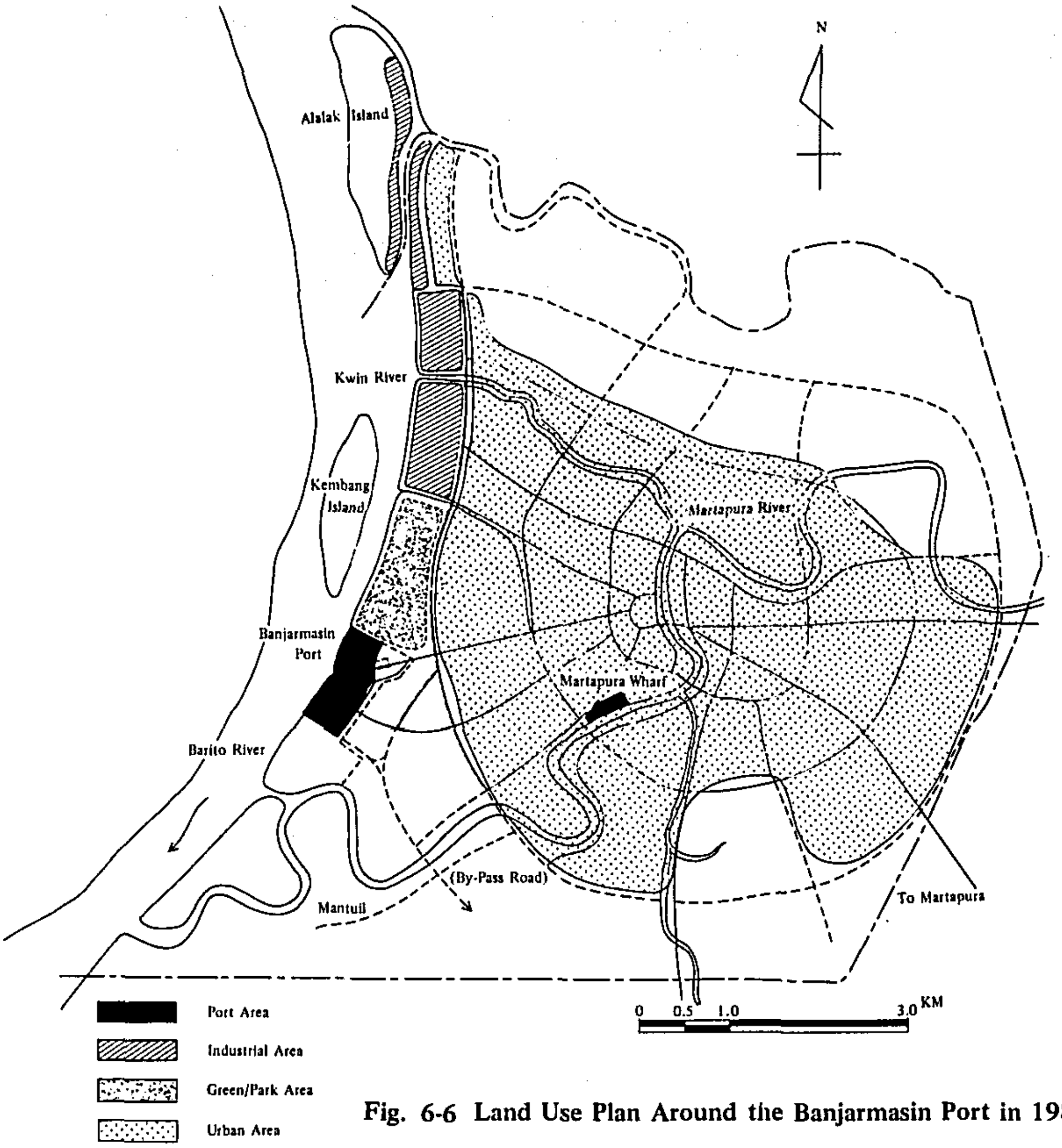


Fig. 6-6 Land Use Plan Around the Banjarmasin Port in 1983

From the above, for rhe maintenance dredging, it would be necessary to have trailing suction hopper dredger prepared for working at all time.

6-10-2. At present, such navigational aids as 3 light buoys along the channel at the estuary, and 3 beacons along the Barito River are installed.

In Tg. Pedata Tua at the west bank of the river mouth, the pilotage base is established so as to render the service of pilotage for such vessels whose tonnages are of more than 150 tons as call into the port.

This waterway, dreging of which is completed in 1976 at the mouth of the river, is narrow and long with the width of 100 m and the length of approximately 14.5 Km.

Together with the completion of the waterway, it is expected that the number of vessels and the type of vessels that call in the port shall remarkably increase.

Accordingly it is necessary to install the light buoys along the channel as soon as possible.

And at the same time, it would be effective to have light tower established so as to give the sight of the waterway, for the reason that the channel has long extention with shallow waters on both sides of the river.

It is required to maintain and to repair the buoys to keep navigational aid for shipping, because the buoys were often lost or damaged reportedly by the log rafts crossing the channel.

And at the same time, the considerable number of the spares of the light buoys should be provided at all times to cover the loss and damage and for use in good time.

In the Banjarmasin Port, the diurnal tide is predominant, so that it will be required to utilize at high tide in the nighttime. Further, on the supposition that the operation on maintenance dredging will extend into the nighttime, sufficient maintenance of the lighted buoys is indispensable.

An extention of approximately 25 Km along the channel of the Barito River has slightly bent waterway, it is necessary to assist the navigation of vessels in providing with the light towers and marker buoys.

In addition to the above, attention should also be paid to further provision of pilot boats and tug boats etc.

6-11. Implementation Schedule

The implementation schedule is shown in Fig. 6-7. The investment in the first phase planning starts with 1978. The acquisition of land is assumed to be complete in the first two years.

The full-scale work is scheduled to start in 1979, considering one year of perparatory period. However, the work only on the buoy berths is scheduled to start in 1978 so that the loading of the logs being made now in the Taboneo basin can be carried out in the basin near Banjarmasin port as soon as possible. In connection with this work, however, preparations including engineering will be needed during 1977.

6-12. Cost Estimation

6-12-1. The cost of construction by type of work and year is shown in Table 6-14.

Because of the assumption that the cargo handling of the processed timbers is to be made all on the water surface without going through the wharf, the required extension of the wharf has become short in this plan. The local & sailing vessels wharf is to be built along the banks of the Barito River, and the dreging required for the artificially excavated basin is put off after the year 1984 onward. For these reasons, the amount of investment in the first phase (1978 - 1983) has been reduced by comparison with the amount estimated in the Interim Report.

6-12-2. The conversion rate of 415 Rupies to one dollar (U.S.) was used. The contingency which are 30% of the total cost are included. This is becuase the possibility is anticipated that there will be a modification in the design of the buildings due to the appreciably poor soil conditions in the candidate area for the construction of the port terminal. The increase in cost during the construction period is not included in this cost estimation.

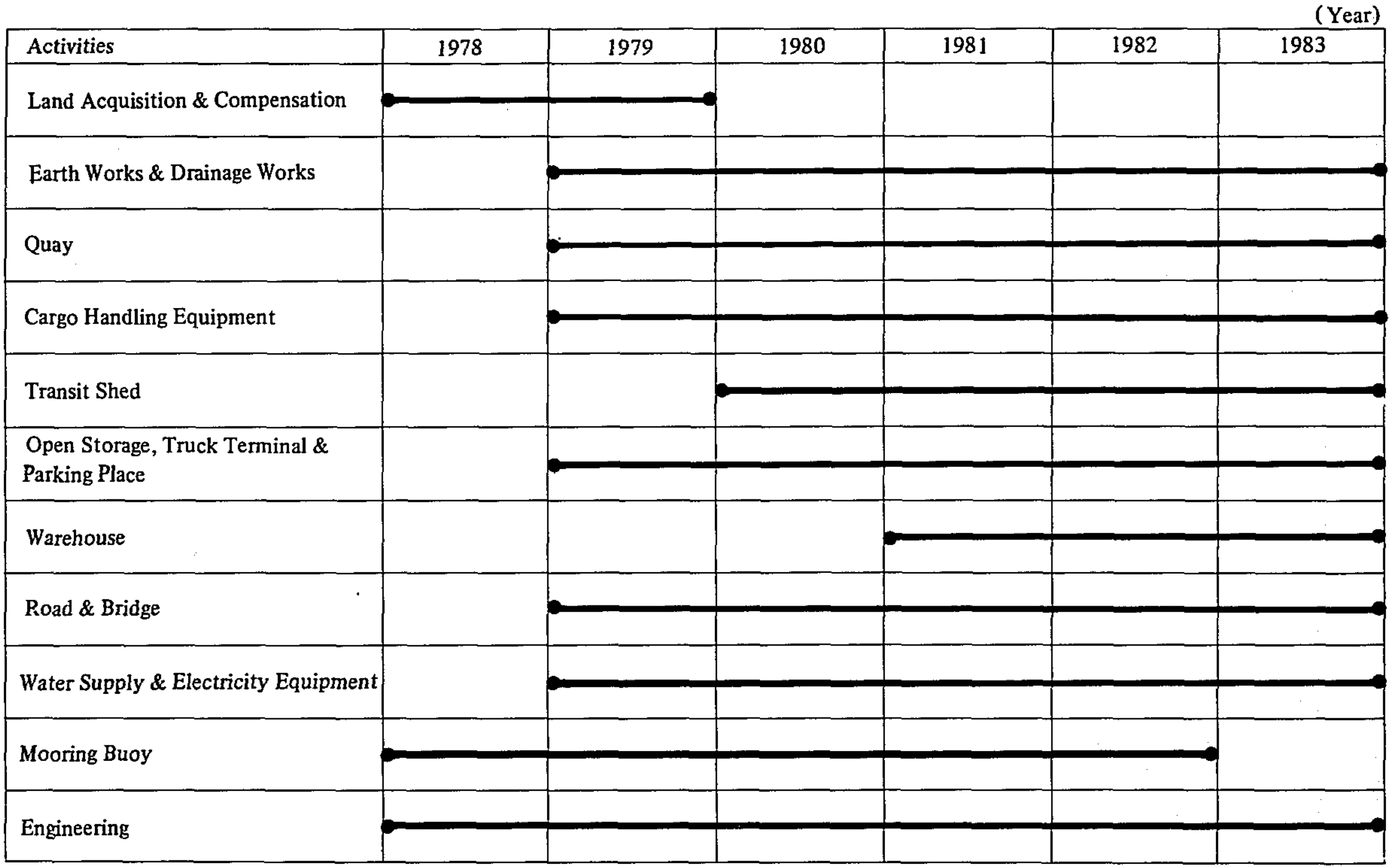


Fig. 6-7 Implementation Schedule (1978 – 1983)

Table 6-14 Estimated Capital Costs of PLAN-I (1978 – 1983)

Unit: 1,000 U.S. Dollars

Activities	Quantity	1978 Local	1978 Foreign	1978 Total	1979 Local	1979 Foreign	1979 Total	1980 Local	1980 Foreign	1980 Total	1981 Local	1981 Foreign	1981 Total	1982 Local	1982 Foreign	1982 Total	1983 Local	1983 Foreign	1983 Total	Grand Total Local	Grand Total Foreign	Grand Total Total
Land Acquisition & Compensation	Land Acquisition 348,000 m², Building Compensation 287,800 m²	1,990	–	1,990	500	–	500	–	–	–	–	–	–	–	–	–	–	–	–	2,490	–	2,490
Earth Works & Drainage Works	518,900 m²	–	–	–	990	–	990	560	–	560	580	–	580	600	–	600	2,120	–	2,120	4,850	–	4,850
Quay – 10 m – 4 m Transitional Part	370 m 470 m 30 m	–	–	–	1,140	1,640	2,780	900	1,300	2,200	970	1,400	2,370	1,070	1,540	2,610	760	1,090	1,850	4,840	6,970	11,810
Cargo Handling Equipment	30 Forklifts, 4 Mobilcranes	–	–	–	30	90	120	20	70	90	20	80	100	30	80	110	20	70	90	120	390	510
Transit Shed	16,500 m²	–	–	–	–	–	–	440	430	870	660	640	1,300	660	640	1,300	660	640	1,300	2,420	2,350	4,770
Open Storage & Parking Place	34,200 m²	–	–	–	70	40	110	90	50	140	50	30	80	80	40	120	50	30	80	340	190	530
Warehouse	19,900 m²	–	–	–	–	–	–	–	–	–	960	940	1,900	960	940	1,900	990	960	1,950	2,910	2,840	5,750
Road & Bridge,	*Road 108,240 m², 3 Bridge*	–	–	–	400	220	620	660	590	1,250	390	220	610	390	220	610	510	290	800	2,350	1,540	3,890
Water Supply	SUM	–	–	–	60	30	90	40	20	60	30	20	50	30	20	50	30	20	50	190	110	300
Electricity Equipment	SUM	–	–	–	120	60	180	80	40	120	70	40	110	70	40	110	60	30	90	400	210	610
Mooring Buoy	8 Buoys	240	280	520	60	70	130	60	70	130	60	70	130	60	70	130	–	–	–	480	560	1,040
Others	1 truck scale, 4 Gatehouses, Greenzone 30,400 m²	–	–	–	–	–	–	40	–	40	20	–	20	100	80	180	170	–	170	330	80	410
Engineering		20	10	30	90	90	180	80	100	180	120	130	250	120	140	260	130	110	240	560	580	1,140
Contingency		680	90	770	1,040	670	1,710	890	800	1,690	1,180	1,070	2,250	1,250	1,140	2,390	1,650	970	2,620	6,690	4,740	11,430
Total		2,930	380	3,310	4,500	2,910	7,410	3,860	3,470	7,330	5,110	4,640	9,750	5,420	4,950	10,370	7,150	4,210	11,360	28,970	20,560	49,530

Note: All cost are based on 1976 construction prices

Chapter-7

Economic Analyses

CHAPTER 7

ECONOMIC ANALYSES

7-1. Methodology

Development of Banjarmasin Port will act an important role to achieve the objective of regional development plan. In the absence of development or improvement of Banjarmasin Port and other infrastructures related to the regional development, character of area to be developed will be extremely obscure resulting difficulty in inviting industries, stagnant commercial activities, and stop of progress of primary industries such as agriculture etc. As a result, there will never be an increase of income in the projected area so that the regional difference will expand increasingly and that improvement of the level of living standard is hardly expectable. In other words, the development of Banjarmasin Port is a trigger to that of the projected area, and its benefit is immeasurably great. It is not too much to say that the investment for improvement of the port is finite but that the benefit brought about by such improvement is infinite. In the following will now be presented the numerical representation of the benefit as far as practicable in use of the available data.

In making economic analyses on the development plan for Banjarmasin Port, the following items should be taken into consideration:

(1) The handling of cargoes is, at present time, performed at about 4 places, each being located considerably far. That is, the log which is amount to approximately 60 percent of all cargoes being handled, is handled as export at Taboneo Anchorage in ocean, about 20 percent of them is handled as inbound and outbound by sailing vessels and local boats at Martapura Wharf, oil about 10 percent of them is handled as inbound at a specialized marine terminal, and the remainder 10 percent is handled as export, import, inbound and outbound at Trisakti Wharf. However, since the dredging of the access channel at Barito River mouth has been completed in 1976, it is assumed that the logs loading is from now on reduced at Taboneo Anchorage but increased at Barito River Anchorage near Trisakti Wharf.

(2) Entering of large ocean going vessels to Banjarmasin Port was impossible due to the bottleneck of bar at Barito River mouth. But upon completion of the dredging in 1976, entering to Banjarmasin Port became possible for vessels up to 10,000 D.W.T., thus Banjarmasin Port began to change to a real foreign trade harbor.

(3) Population density of service area of Banjarmasin Port is extremely low and economic activities are conventionally somewhat stagnant, and majority of harbor cargoes are export logs with others in few quantity.

From the above description, it may be said that the main purposes of the development project of Banjarmasin Port are to provide more intensive port functions as an industrial base in addition to the function as a junction between sea and land transportation for also utilizing it in the urban formation. In other words, its objective is to stimulate regional economy for the economic growth.

Thus in the economic analyses two major items, the logs handled conventionally in Toboneo and the other cargoes handled at Trisakti Wharf and Martapula Wharf, are analyzed to check changes in flow of cargoes, saving of costs and reduction of time as a benefit. Then a part of the increase in added value of the logs was computed as a benefit brought by the development.

7-2. Key Assumptions

The following assumptions are made to clarify the complication since three elements consisting of Service Area development, the river mouth passage dredging and the intensified extension of port facilities are involved:

(1) Channel dredging work for Barito River mouth is already completed, but its cost is included in the costs for the project since the work is considered to be a part of the harbor facilities to be developed from now for Banjarmasin Port.

(2) Maintenance dredging work is assumed to be continuous since the access channel dredged is accumulated by sands.

(3) Development of service area may be in low level and amount of cargoes handled in the port will rarely increase if the port development is ignored. Also it is expected that the service area will be hardly developed and effect of port development will be drastically reduced if other guiding policies of regional development are not introduced together with the port development. Therefore, it is extremely difficult to compute the development effect to the service area only by considering simply the relation of investment to the port facilities. In order to avoid overestimating the benefit, the benefit expected from new export goods and new outboud goods such as palm oil, minerals or rice has not been included in the computation.

7.3. *Analyses on Banjarmasin Port*

7-3-1. Cargo Flow at Trisakti and Martapula Wharfs

First let consider the flow of cargoes at Trisakti Wharf and Maltapula Wharf where the cargoes other than logs are handled.

The flow of cargoes at Trisakti Wharf and Martapura Wharf, and the changes due to the port development are indicated in Figure 7-1.

The basic changes expected up to the year of 2000 are described below.

1) Due to increase in direct entering frequency of ocean going vessels to Banjarmasin Port, the foreign trade cargoes conventionally transported via Surabaya Port or Tg. Priok Port will be decreased, and foreign trade cargoes directly imported or exported will be increased.

2) The domestic trade function of Martapula Wharf conventionally used by sailing vessels or local boats will be shifted to domestic trade wharf to be built downstream Trisakti Wharf.

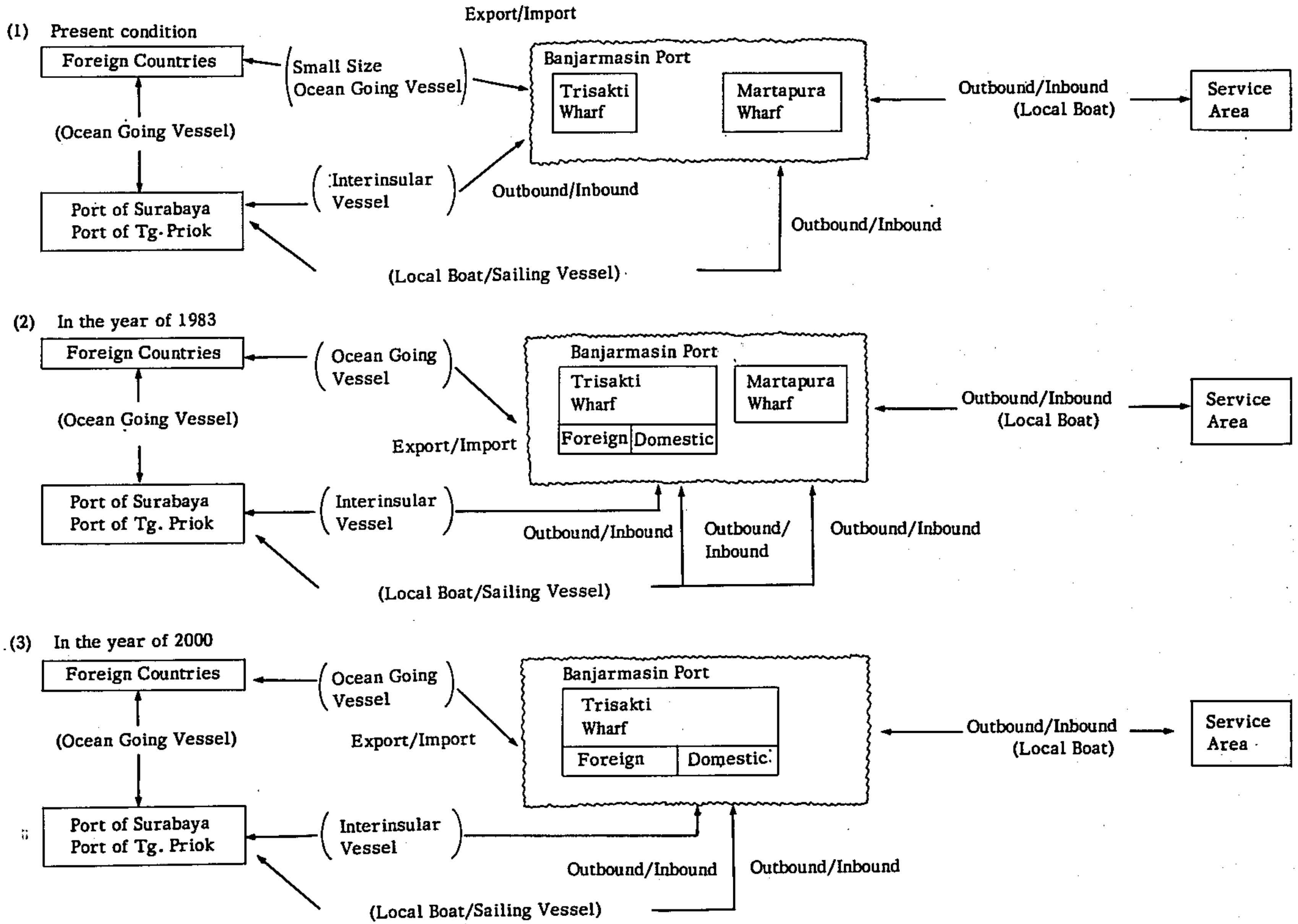


Fig. 7-1 Changes of Cargo Flow

In result, the following benefits will be expected:

(1) Reduction in freight, cargo-handling charge, terminal freightage and sheddage due to direct import of goods

Since large ocean going vessels were unable to enter Banjarmasin Port, a part of inported goods was transported as domestic cargo via Surabaya Port or Tg. Priok Port. Since large ocean going vessels are able to enter the port after the port development, the most of this indirect import will be replaced by the direct import after the development so that savings in freight from these ports, cargo-handling charge, terminal freightage and sheddage at these ports can be computed as benefits.

In 1975, amount of cargoes imported via Port of Surabaya or Port of Tg. Priok was 44,000 tons (refer to Chapter 3). If the port facilities had been improved to allow the entry of large vessels, 13,000 tons (mainly foods) of that indirect import cargoes would have been directly imported without going through Surabaya Port or Tg. Priok Port. In other words, amount of possible direct import in 1975 would be 30,000 tons (17,000 tons of import + 13,000 tons assumed import), and 13,000 tons (43.3% of possible direct import) were actually imported indirectly because the port had not been developed. By same approach, if it is assumed that the port is undeveloped in coming years, a part of import cargoes assumed in Chapter 3 may be shipped to Banjarmasin Port via Surabaya Port or Tg. Priok Port as conventionally done in the past. This amount will become 30,000 tons in 1983 (42.9% of import), and 100,000 tons in 2000 (41.7% of import). Details of amount of possible indirect import cargoes, savings in freight, cargo-handling charge, terminal freightage and sheddage in unit cost stated above are all indicated in Table 7-1. To simplify the computation, it is assumed that all cargoes are transported via Surabaya Port located near Banjarmasin Port.

Table 7-1 Volume of Possible Indirect Import of Cargoes and Savings in Unit Cost

	Volume (1,000 t)			Reduced Unit Cost (U.S.$/t)	
	1975	1983	2000	Freight	Cargo-handling Terminal Freightage Sheddage
Possible Indirect Import (or Possible Direct Import)					
Food, Cement, Fertilizer	(9)	14	25	4.22	1.37
Others	(4)	16	75	13.12	2.05
Total	(13)	30	100		
Import (or Possible Direct Import)	(30)	70	240		

The benefit computed from equation below with data in above table is shown in Tables 7-4 and 7-5.

$$B = Vi \times [F + (C \times 2)]$$

Figures are shown as follows:

B = Benefit computed

Vi = Volume of indirect import cargoes

F = Freight from transit port to Banjarmasin Port

C = Sum of cargo-handling charge, terminal freightage and sheddage at transit port

(2) Relieving congestion of domestic trade wharf

Improvement of cargo-handling capacity at wharf and increase of loading by interinsular vessels are expected in future handling of inbound/outbound cargoes (refer to Chapter 6). If port development is assumed to be not done, inbound/outbound cargoes will be handled by existing facilities so that improvement of cargo-handling capacity and increase of loading by interinsular vessels are not expected.

On the other hand, new outbound/inbound goods such as palm oil, minerals and rice will not be developed without port development but other cargoes may increase naturally as population grows. In the result, domestic trade wharf handling inbound/outbound cargoes may be congested about twice in 1983 and about 5 times in 2000 compared to present condition as indicated in table below. Relieving increase of days of stay at anchorage resulted from the congestion may be computed as benefit.

Table 7-2 Comparison of Congestion at Domestic Trade Wharf

		Interinsular Vessel			Local Boat Sailing Vessel		
		1975	1983	2000	1975	1983	2000
Cargo Volume (1,000t)	With *	94	260	1,055	281	260	1,055
	Without		135	420		405	1,258
Number of Arrival Vessels	With	382	520	2,110	3,157	2,600	10,540
	Without		270	840		4,050	12,580
Rate of Ships Congestion	With	1	0.6	0.7	1	0.5	0.6
	Without		1.8	5.2		1.4	4.5
Increase of Days of Stay at Anchorage (days)	Without		1	6		1	6
Cost of Stay at Anchorage (U.S.$ per day)			900	900		100	100

* Note: "With" means with development.
"Without" means without development.

Five times more congestion may generally exceed the allowable limit of facilities but it may be computed for Banjarmasin Port that cargoes can be handled by use of barges since there is no other port near Banjarmasin for the temporary stay for the vessels. The benefit computed from equation below with data shown in above table is indicated in Tables 7-4 and 7-5.

$$\begin{pmatrix}\text{Cost of Stay at Anchorage}\\ \text{per Day}\end{pmatrix} \times \begin{pmatrix}\text{Increase of Days}\\ \text{of Stay at Anchorage}\end{pmatrix} \times \begin{pmatrix}\text{Number of}\\ \text{Arrival Vessels}\end{pmatrix}$$

7-3-2. Flow of Logs Loading

The flow of logs loading and changes of flow due to the port development are indicated in Figure 7-2. Major change is that logs carriers conventionally loading the logs in ocean are able to enter the Barito River directly toward the logs loading basin of Banjarmasin after complete dredging works of access channel. Thus, as the result of change of logs loading place, reduction in days of stay at anchorage, in the rates of losing and damage of logs and in towing fee will be expected as benefit.

Comparing former logs loading in ocean to logs loading in the Barito River basin developed, obstacles associated with loading time will be eliminated. These obstacles are:

1) Stop of cargo-handling due to poor visibility in rainy and stormy weather, rolling and high waves during west monsoon period.
2) Low handling efficiency due to log jumping caused by rolling and waves.
3) Time loss spent for round trip by tag boats between timber basin and anchorage.
4) Long time required for waiting inspector for necessary export permits.

By eliminating these obstalces, approximately two days of stay at anchorage may be saved. Also, about 5% of logs is usually lost by sinking or drifting during stormy weather or rolling, but this can be eliminated completely when loading is made in river channel. The percentage of damage may be also reduced by 1%. In addition, due to reduced towing distance by tag boat, the towing fee needed between Trisakti Wharf and Taboneo Timber Basin and between Taboneo Timber Basin and logs carrier anchorage can be saved. The towing fee thus saved will be approximately 1.6 U.S.$/m³.

The above benefit computed by using equation below is indicated in Tables 7-4 and 7-5.

$$B = \left(C \times \frac{V_E}{V_L} \times R\right) + \left(V_E \times P \times L\right) + \left(V_E \times T\right)$$

Figures are shwon as follows:

B = Benefit computed

C = Cost of stay at anchorage per vessel (2,000 U.S. $/day)

V_E = Volume of logs to export (1975 777,000 m^3; 1983 1,280,000 m^3; 2000 0 m^3; refer to Chapter 3)

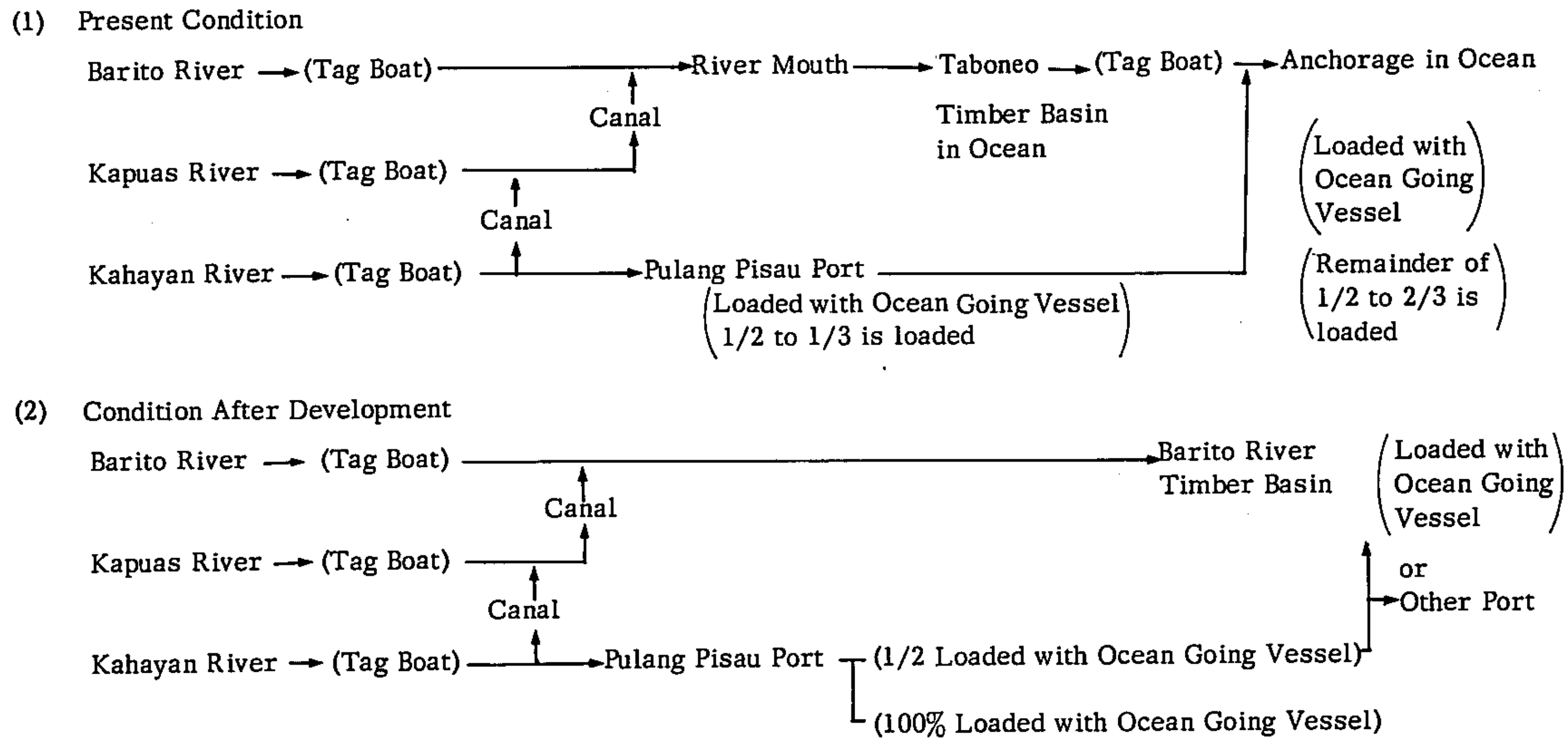
V_L = Volume of loading per vessel (6,000 m^3)

R = Reduction of days of stay at anchorage per vessel

P = F.O.B.price of logs to export (50 U.S. $/$m^3$)

L = Reduction of losing and damage rate of logs

T = Reduction of towing fee



Note: As a result of dredging for the Kahayan River mouth, loading of 5,000 m^3 will become possible at Pulang Pisau. But its channel is meandering so that navigation with full loading may be dangerous during rainy season.

Fig. 7-2 Changes of Logs Loading

The reduction of days of stay at anchorage for ocean going vessels is computed as benefit since it is considered to be a productivity improvement for Indonesian vessels, a reduction in demurrage payment for Indonesian-chartered vessels, and elimination of rise of surcharge and freight for Indonesia for foreign vessels, each being beneficial to Indonesia.

7-3-3. Processing of Timber

At present, the export timber is shipped largely in the form of logs. It is planned, here, to turn gradually into the export of processed timber including sawed timber and plywood along with improvement and expansion of the facilities in Banjarmasin Port (see Chapter 3). If Banjarmasin Port is not developed and large ocean going vessels are unable to enter to the port, the processed timber must be exported via Surabaya Port or others with added freight and handling charges in these ports. As a result, F.O.B. price certainly goes up losing its competing force in the market. Then, the timber planned for processing for export will have to be exported in the form of logs as is before. Thus, the port development is a prerequisite for development of the timber processing for export, and with the port development, an increase in the added value with processing is conceivable as benefit.

When the F.O.B. price of processed timber is assumed to be 90 US$/m^3, the net added value of processed timber upon deduction of the processing equipment cost (5.8 US$/m^3 in 8 years depreciation) and other expenses (except personnel expense) is calculated as given below.

Processed timber price 90 US$/m^3 – Log cost 70 US$/m^3 (Yield rate 70%) – Equipment investment 5.8 US$/m^3 – Other expenses 2.4 US$/m^3 = 11.8 US$/m^3.

In general, the benefit of development is apportioned to the amounts of investment to port development and to processing equipment. Then, according to the ratio of the amount of investment to port development and that to processing equipment up to the year of 2000 (that is 217,000 US$: 63,000 US$ ≒ 8:2), 80 percent of the added value may be taken as a direct benefit resulting from the port development. However, in the case of Banjarmasin Port, 1) there is already production of sawed timber, plywood, etc. for domestic use, and upon such base of production, it will be relatively easy to introduce the measures of attracting the processing equipment investments and strict specifications of the products so that the amount of processing equipment investment is likely to be lower than that calculated above, and 2) the added value on which the foregoing calculation is base is not the difference between the product prices (90 – 70 = 20 US$/m^3) but the figure of net added value deducting the processing equipment investment cost, etc. In consideration of the foregoing, a 90 percent value of said figure at 11.8 US$/m^3 was employed as the direct benefit of the port development.

In the absence of port development, the timber would be exported in the form of logs. Thus, the benefit accruing from change of the loading place of logs was included as described in Paragraph 7-3-2, and the quantity of logs required for processing was calculated as given below with a yield rate at 70 percent.

Table 7-3 **Volume of Export of Processed Timber and Volume of Logs Required for Processing**

	Volume of Processed Timber		Volume of Required Logs ($1,000 m^3$)
	1,000 t	$1,000 m^3$	
1975	16	21	30
1983	360	462	660
2000	700	897	1,281

Result of calculation by equation indicated below is shown in Tables 7-4 and 7-5.

$$B = (V_p \times A) \times 0.9 + (C \times \frac{V_R}{V_L} \times R) + (V_R \times P \times L) + (V_R \times T)$$

Figures are shown as follows:

B	=	Benefit computed
V_p	=	Volume of processed timber
A	=	Net added value
C	=	Cost of stay at anchorage per vessel
V_R	=	Volume of required logs to process
V_L	=	Volume of loading per vessel
R	=	Reduction of days of stay at anchorage per vessel
P	=	F.O.B. price of logs to export
L	=	Reduction of losing and damage rate of logs
T	=	Reduction of towing fee

As described in Section 7-2, the development benefits of the newly developed commodities for export (plam oil, minerals, rice, etc.) having no infrastructure of production were not at all taken up as direct benefit incident to port development.

7-4. Shadow Price

In the cost estimation for the economic analyses, the shadow price must be taken into consideration. The purposes of the shadow price computation are to properly evaluate the foreign currency exchange rates, wages of unskilled labours and cost of capital in the national economic point of view. But computing work for converted prices is extremely difficult in most of cases. Since required statistic information is not available in reality, analysis using wide range of figures is usually not conducted. The shadow prices of this report are computed and indicated as stated below.

(1) Foreign exchange rate

Proper foreign exchange rate can be computed by comparing domestic prices by good and by area along the national boundary to the international prices if such figures are available. But in reality, these figures are almost impossible to obtain. Generally a nation having insufficient reserve in foreign currencies controls the foreign exchange severely. Actual value of foreign currency in such nation is relatively lowered so that a shadow price for foreign exchange rate is calculated depending upon degree of control on foreign exchange and the international balance of payment. The Republic of Indonesia is not controlling the foreign exchange at this time and possibility of anxiety on international balance of payment that may bring a reduced value of Rupiah, will not exist in years to come so that shadow rate is not employed in this economic analyses but an official exchange rate (U.S. $1.00 = 415 Rupiahs) is used. Usually a shadow price is not employed if difference between official rate and free market rate is less than 10%.

(2) Wage rate of unskilled labour

Mr. Little and Mr. Mirrlees employ the following equation for computing the wage rate of unskilled labour:

$$W = m + \Delta c \ (1 - 1/s)$$

where W : shadow wage rate

m : opportunity cost of employment

Δc (1-1/s): increment of consumption

S : $\frac{\text{investment}}{\text{consumption}}$

However, each statistic data concerning tendency to consume for skilled labour and unskilled labour in the service area of Banjarmasin is not available so that opportunity cost of employment is estimated from the relation between port sector and agriculture sector assuming W = m. GDP per person in agricultural/forestry/fishery sector in service area is computed as 131,000 rupiahs/year in 1973. When this is computed with a yearly growth rate of 5.3%, GDP per person in 1976 will be 153,000 rupiahs/year (refer to Chapter 3). If this figure is used for 6-day work per week, wage per day for agricultural/forestry/fishery sector will be 490 rupiahs per day per person. On the other hand, wage for unskilled labour in the City of Banjarmasin is 750 rupiahs per person per day. If these workers are unemployed and return to agricultural/forestry/fishery sector and work as average workers, they will get 490 rupiahs per day per person, resulting a ratio of 0.65 between present and new wages.

The shadow wage rate will be computed by using the above figure with a consideration of unemployment condition. Statistic figures for unemployment rate of this area are not available so that a shadow wage rate of 0.8 will be used by considering extremely scarce population distribution of Banjarmasin in comparison with Java Island.

Opportunity cost of capital is equal to rate of return yielded from an invested project selected from a number of projects. Therefore, opportunity cost of capital is not obtained unless other possible projects are known. For this reason, internal rate of return (rate of return when net present value obtained by deducting cost from benefit is zero) was computed in this economic analyses. Cost benefit ratio (benefit ÷ cost) was also indicated at a discount rate of 15%. Loan interest rate of national banks in Indonesia is varied widely from 12% to 24% yearly, but loan interest rate for capital investment is 15%. Considering this rate, discount rate of 15% shown above may be reasonable.

7-5. Cost Benefit Analyses

The construction costs computed in Chapters 5 and 6 are costs used in financial analyses. The economic cost is computed and indicated below by deducting taxes applied to import materials and shadow price from the financial cost.

(U.S.$. thousands)

	Financial Cost	Taxes	Shadow Price	Economic Cost
Plan I	49,530	6,730	1,980	40,820
Plan II	253,960	38,930	10,160	204,870

Overall tables of costs and benefits computed by use of prices in 1976 for 30 years of life time are indicated in Tables 7-4 and 7-5. The internal rate of return and cost benefit ratio at a discount rate of 15% are computed and indicated below. These will prove the extremely high feasibility of this project. (refer to Table 7-6.)

	Internal Rate of Return	Cost Benefit Ratio (15%)
Plan I	24.1 %	1.42
Plan II	14.9 %	1.00

It should be noted that ratio for Plan II must be slightly lower than that of Plan I technically. Because:

1) Benefit is plunketed after 30 years of life time and benefit after that is covered by the residual value of investment. However, this residual value will be low compared to benefit obtained after this life time when investment is continued up to the year of 2000 as schemed in Plan II.

2) Standard year for prices is the year of 1976 so that benefit for investment near the year of 2000 is considerably discounted as indicated by figures.

Thus Plan II also should be considered as highly feasible project in long-term analysis since it offers a high level internal rate of return of 15%. It is impossible to simply compare the internal rates of return for both Plan I and Plan II and to conclude inferiority of Plan II.

7-6. Sum of Benefits

Lastly the benefits are all summed hereinafter.

(1) Primary benefits (estimated in cost benefit analyses in Paragraph 7-5.)

1) Import goods (mainly necessaries of life so far) transported so far via Surabaya Port or Tg. Priok Port will be directly imported after the port development. In the result, freight from these ports to Banjarmasin Port, cargo-handling charge, terminal freightage and sheddage at these ports can be saved.

2) Amount of inbound/outbound cargoes will be increased as population grows. If the increased amount of cargoes is handled by existing capacity of facilities, days of stay at anchorage for interinsular vessels, local boats and sailing vessels will greatly increase, but this demurrage can be all saved after the port development.

3) Loading place for export logs will be shifted from Taboneo in ocean to near Trisakti Wharf in the Barito River channel. In the result, days of stay at anchorage for vessels will be reduced due to improved cargo-handling ability, rates of losing and damage of logs will be reduced and towing fee will be saved.

4) Timber mostly exported as logs so far will be exported as sawed timber and plywood after the development of port. Increase in added value is expected as a result of higher level of manufacturing process.

(2) Secondary benefits (indirect effects)

1) Agriculture (including rubber) and forestry development will be promoted.

2) Development of new export and outbound goods (palm oil, minerals, rice, etc.) will be promoted.

3) Collection and distribution system for cargoes will be improved.

4) Freight will be lowered as a result of improved services of port facilities.

5) Development of Banjarmasin City will be resulted.

Table 7-4 Plan I: Cost Benefit Table (US$ thousands)

		Cost					Benefit					Discounted Value (I.R.R. 24%)	
		Channel Dredging	Port Investment	Maintenance Dredging	Increase Operating	Total	Direct Import.	Ships Congestion	Logs Loading	Timber Processing	Total	Cost	Benefit
1	1976	12,000				12,000						12,000	
2	1977			960	120	1,080						871	
3	1978		2,990	960	340	4,290	200		5,060		5,260	2,790	3,421
4	1979		6,150	960	650	7,760	220		5,360		5,580	4,070	2,927
5	1980		5,930	960	820	7,710	250		5,680	2,630	8,560	3,261	3,621
6	1981		7,880	960	1,180	10,020	290		6,010	3,870	10,170	3,418	3,469
7	1982		8,380	960	1,610	10,950	330		6,370	5,690	12,390	3,012	3,408
8	1983		9,490	960	2,220	12,670	370	650	6,740	8,370	16,130	2,810	3,578
9	1984			960	2,220	3,180	370	650	6,740	8,370	16,130	569	2,886
10	1985			960	2,220	3,180	370	650	6,740	8,370	16,130	459	2,328
11	1986			960	2,220	3,180	370	650	6,740	8,370	16,130	370	1,878
12	1987			960	2,220	3,180	370	650	6,740	8,370	16,130	298	1,513
13	1988			960	2,220	3,180	370	650	6,740	8,370	16,130	241	1,221
14	1989			960	2,220	3,180	370	650	6,740	8,370	16,130	194	984
15	1990			960	2,220	3,180	370	650	6,740	8,370	16,130	156	794
16	1991			960	2,220	3,180	370	650	6,740	8,370	16,130	126	640
17	1992			960	2,220	3,180	370	650	6,740	8,370	16,130	102	510
18	1993			960	2,220	3,180	370	650	6,740	8,370	16,130	82	416
19	1994			960	2,220	3,180	370	650	6,740	8,370	16,130	66	336
20	1995			960	2,220	3,180	370	650	6,740	8,370	16,130	53	271
21	1996			960	2,220	3,180	370	650	6,740	8,370	16,130	43	218
22	1997			960	2,220	3,180	370	650	6,740	8,370	16,130	35	176
23	1998			960	2,220	3,180	370	650	6,740	8,370	16,130	28	142
24	1999			960	2,220	3,180	370	650	6,740	8,370	16,130	23	115
25	2000			960	2,220	3,180	370	650	6,740	8,370	16,130	18	92
26	2001			960	2,220	3,180	370	650	6,740	8,370	16,130	15	74
27	2002			960	2,220	3,180	370	650	6,740	8,370	16,130	12	60
28	2003			960	2,220	3,180	370	650	6,740	8,370	16,130	10	48
29	2004			960	2,220	3,180	370	650	6,740	8,370	16,130	8	39
30	2005			960	2,220	3,180	370	650	6,740	8,370	16,130	6	32
Residual Value											20,610		41
Total		12,000	40,820	27,840	55,780	136,440	9,800	14,950	183,500	204,700	433,560	35,146	35,244

I.R.R. = 24.1%

Table 7-5 Plan II: Cost Benefit Table (US$ thousands)

		Cost					Benefit					Discounted Value (I.R.R. 15%)	
		Channel Dredging	Port Investment	Maintenance Dredging	Increase Operating	Total	Direct Import	Ships Congestion	Logs Loading	Timber Processing	Total	Cost	Benefit
1	1976	12,000				12,000						12,000	
2	1977			960	120	1,080						939	
3	1978		2,990	960	340	4,290	200		5,060		5,260	3,244	3,977
4	1979		6,150	960	650	7,760	220		5,360		5,580	5,102	3,672
5	1980		5,930	960	820	7,710	250		5,680	2,630	8,560	4,409	4,896
6	1981		7,880	960	1,180	10,020	290		6,010	3,870	10,170	4,982	5,054
7	1982		8,380	960	1,610	10,950	330		6,370	5,690	12,390	4,734	5,352
8	1983		9,490	960	2,220	12,670	370	650	6,740	8,370	16,130	4,763	6,065
9	1984		9,650	960	2,530	13,140	400	770	7,140	8,700	17.010	4,295	5,562
10	1985		9,650	960	2,800	13,410	440	920	7,560	9,050	17,970	3,812	5,103
11	1986		9,650	960	3,080	13,690	470	1,090	5,790	9,420	16,770	3,384	4,142
12	1987		9,650	960	3,400	14,010	510	1,290	4,430	9,790	16,020	3,011	3,444
13	1988		9,650	960	3,730	14,340	550	1,530	3,400	10,180	15,660	2,680	2,928
14	1989		9,650	960	3,780	14,390	600	1,820	2,600	10,590	15,610	2,338	2,544
15	1990		9,650	960	3,980	14,590	650	2,160	2,000	11,010	15,820	2,062	2,231
16	1991		9,650	960	4,340	14,950	700	2,570	1,530	11,450	16,250	1,837	1,999
17	1992		9,650	960	4,750	15,360	760	3,050	1,170	11,910	16,890	1,642	1,807
18	1993		9,650	960	5,490	16,100	820	3,630	900	12,390	17,740	1,496	1,650
19	1994		9,650	960	7,370	17,980	890	4,310	690	12,890	18,780	1,453	1,521
20	1995		9,650	960	7,690	18,300	970	5,120	530	13,400	20,020	1,286	1,401
21	1996		9,650	960	8,310	18,920	1,050	6,080		13,940	21,070	1,156	1,285
22	1997		9,650	960	9,230	19,840	1,130	7,230		14,490	22,850	1,054	1,211
23	1998		9,650	960	9,980	20,590	1,230	8,590		15,070	24,890	951	1,145
24	1999		9,650	960	10,530	21,140	1,330	10,200		15,680	27,210	850	1,088
25	2000		9,650	960	10,800	21,410	1,470	12,080		16,260	29,810	747	1,043
26	2001			960	10,800	11,760	1,470	12,080		16,260	29,810	358	894
27	2002			960	10,800	11,760	1,470	12,080		16,260	29,810	310	775
28	2003			960	10,800	11,760	1,470	12,080		16,260	29,810	270	686
29	2004			960	10,800	11,760	1,470	12,080		16,260	29,810	235	596
30	2005			960	10,800	11,760	1,470	12,080		16,260	29,810	205	507
Residual Value											165,420		2,812
Total		12,000	204,870	27,840	162,730	407,440	22,980	133,490	72,960	308,080	702,930	75,605	75,390

I.R.R. = 14.9 %

Table 7-6 Cost Benefit Ratio

		Plan I (15%)		Plan II (15%)	
		Cost	Benefit	Cost	Benefit
1	1976	12,000		12,000	
2	1977	939		939	
3	1978	3,244	3,977	3,244	3,977
4	1979	5,102	3,672	5,102	3,672
5	1980	4,409	4,896	4,409	4,896
6	1981	4,982	5,054	4,982	5,054
7	1982	4,734	5,352	4,734	5,352
8	1983	4,763	6,065	4,763	6,065
9	1984	1,040	5,275	4,295	5,562
10	1985	904	4,581	3,812	5,103
11	1986	786	3,984	3,384	4,142
12	1987	683	3,468	3,011	3,444
13	1988	594	3,016	2,680	2,928
14	1089	517	2,629	2,338	2,544
15	1990	449	2,274	2,062	2,231
16	1991	391	1,984	1,837	1,999
17	1992	340	1,726	1,642	1,807
18	1993	295	1,500	1,496	1,650
19	1994	257	1,307	1,453	1,521
20	1995	224	1,129	1,286	1,401
21	1996	194	984	1,156	1,285
22	1997	169	855	1,054	1,211
23	1998	147	742	951	1,145
24	1999	128	645	850	1,088
25	2000	111	565	747	1,043
26	2001	97	484	358	894
27	2002	84	419	310	775
28	2003	73	371	270	686
29	2004	64	323	235	596
30	2005	55	274	205	507
Residual Value			350		2,812
Total		47,775	67,901	75,605	75,390

Cost Behefit Ratio

Plan I = 1.421

Plan II = 0.997

Chapter-8

Financial Plan and Analyses

CHAPTER 8

FINANCIAL PLAN AND ANALYSES

8-1. Introduction

Universal criteria for evaluation of financial viabilities are hardly obtainable. Where a new port is constructed, the criteria of viability are, of course, different from those in the case of expanding an existing port, and also from those in the case of another new port depending on the character of the project. What is important here may be summed up in two points: (1) whether or not the accounting procedures are established, that is, 1) if the evaluation of assets is made properly, 2) if the depreciation is made adequately, 3) if a long-term investment plan is established and 4) if there is eatablished a system permitting flexible disbursement of the expenses depending on the change in the situation; and (2) if the revenue is sufficient enough to accommodate the expenses required for operation and also for payment of the debt services and the investment fund in the future. For the former, there were recommendations made by I.B.R.D. and A.D.B. in the case of Tg. Priok Port so that we thought that the matter would be resolved in the case of Banjarmasin Port. For the latter, we had but to make the calculation upon various assumptions in that there were many problems involved such 1) that there was an increasing possibility of the financial cost principle being weakened in the presence of measures to cope with the inflation, 2) that while Banjarmasin Port investment fund was relying much on the loans from overseas, it was not yet specifically determined from where such loans would be coming, and 3) that Banjarmasin Port had successive investments scheduled up to 2000 so that the specific figures in 2000 would be subject to change.

Thus, in the financial analyses of Banjarmasin Port, the figures calculated upon the following assumptions were taken as the criteria for administrative target, while a sensitivity test was conducted to obtain the figures in the worst case where the level of charges would remain unchanged and the conditions for loan would become stricter in Plan-I. From both above, the financial viability was determined.

The assumptions are given as below.

(1) Upon the cost principle, a self-paying system would be employed, that is, the level of charges capable of accommodating the operating expense, payment of debt services and daily operating fund would have to be maintained. Banjarmasin Port is currently preparing a balance sheet combining all assets and liabilities of the ports belonging to the Fifth District. Here, it was assumed that Banjarmasin Port would hereafter prepare an independent balance sheet and raise funds for its own sake. It would be with reason to stand in the start upon the concept of self-paying as in the ports in Europe and the United States of America.

(2) It was assumed that the development investment capital would be financed by the Indonesian Government's development fund (without interest) and those

borrowed from overseas. The government's development fund would represent the self-capital, and from the character of the port development that would be taken as a project in an under-developed area, the funds to be borrowed should be of low interest loans (or credits) up to 1983 and loans on a commercial basis in and after 1984 when the development would be making a progress along the proper path.

(3) Thd expense of dredging and that of the subsequent maintenance dredging of the access channel at the Barito River mouth were included in the cost in the economic analyses, but in view of the declaration on the part of the Indonesian Government to bear all such expenses with its financial fund, they were not included in the cost in balancing and fund raising. However, from the concept of cost principle, the maintenance dredging expense was taken into account in the basic calculation for establishment of the level of charges (see Section 8-3).

Upon calculation from the foregoing, the financial positions as an administrative target would progress as given below.

(Rp. millions)

	1976	1983	2000
Port Revenue	360	2,430	10,080
Total Assets	1,080	24,230	120,530
Fixed Assets	870	21,490	106,330
Long-term Loans		10,300	35,220
Government Development Fund	510	10,760	53,100

In this chapter, the following standards are employed to make the description simple and understandable with ease.

(1) The 1976 price is taken as a basic price, with calculations made in the unit of million Rp.

(2) The terms, Stage-I and Stage-II, are used:

Stage-I = from 1978 to 1983
(from the start of port development investment to 1983.
Reference: Plan-I = from 1976 to 1983)

Stage-II = from 1984 to 2000
(a period of Plan-II excluding the period of Plan-I.
Reference: Plan-II = from 1976 to 2000)

8-2. Long-term Loans and Fixed Assets

The development project of Banjarmasin Port is carried out in a scale approximately equivalent to development of a new port. Thus, great are the burden of the interest paid on loans and that of the expense for depreciation of the fixed assets, and it will not be too much to say that the balance is governed by these two factors.

First, the proportion of the self-capital or development fund of the Central Government to the investment fund and the conditions of long-term loans will be determined. In the equipment investment of a profit-making industry, more than 30 percent of the self-capital is required generally. The development investment of Banjarmasin Port is intended for improvement of the infrastructures so that at least 50 percent of the investment should be financed by the self-capital. Now, considering the amounts allocated from the government development fund for the development projects of other major ports (such as Tg. Priok or Surabaya), an amount of about 2,500 million Rp. per annum which corresponds to 50 percent of the investment is considered to be an appropriate allocation for Banjarmasin Port. Thus, the Central Government development fund and the long-term loans were apportioned at 50:50 as given below.

(Rp. millions)

	Stage-I	Stage-II
Investment (A)	20,550	84,840
Central Government Development Fund	10,250 (annual 1,710)	42,340 (annual 2,490)
Long-term Loans (or Credits) (B)	10,300	42,500
B/A	50 %	50 %

Further, it was assumed that the conditions of long-term loans would vary from Stage-I to Stage-II as stated in the foregoing in Section 8-1. For the loan condition in Stage-I, a case (a) determined in reference to the loan condition of I.B.R.D. or A.D.B. was made the standard, but another case (b) in consideration of the loan condition of Japan was provided for sensitivity test.

	Stage-I (case (a))	Stage-I (case (b))	Stage-II
Interest Rate (or Charge)	2.0% per annum	3.0% per annum	8.5% per annum
Unredeemed Term	10 years	10 years	5 years
Repayment Term	30 years	20 years	20 years
Total Term	40 years	30 years	25 years

In the appended Table 8-1 is shown the schedule for the long-term loan, or the amount of redemption, balance of loans and interest payable according to the foregoing.

Next, calculation of the depreciation for the fixed assets will be described. For depreciation, the straight line method was employed with the depreciation rates accumulated for the following items to obtain a mean depreciation rate for the assets to be depreciated. For the last years, the standards of the Indonesian Government were followed.

(1) Quay: 0.02 (last 50 years)
(2) Cargo handling equipment: 0.05 (last 20 years)
(3) Transit shed: 0.10 (last 10 years)

(4)	Open storage, truck terminal and parking space:	0.02 (last 50 years)
(5)	Warehouse:	0.03 (last 33 years)
(6)	Road and bridge:	0.01 (last 100 years)
(7)	Water and oil supply equipment:	0.04 (last 25 years
(8)	Power supply and lighting equipment:	0.03 (last 33 years)
(9)	Office building:	0.03 (last 33 years)
(10)	Passenger terminal:	0.03 (last 33 years)
(11)	Palm oil tank:	0.08 (last 12 years)
(12)	Buoy berth:	0.04 (last 25 years)
(13)	Bypass and bridge:	0.01 (last 100 years)
(14)	Others:	0.02 (last 50 years)

In the balance sheet of Banjarmasin Port, the fixed assets are listed with the cumulative depreciation amount added respectively. Thus, in this chapter, this method was followed, while the figure having the cumulative depreciation amount deducted was defined as the net fixed asset and listed separately. Upon the foregoing last years, the mean depreciation rate was calculated at 0.033 (last 30 years). Using this mean depresiation rate, the amount of depreciation, balance of the net fixed assets and balance of the fixed assets were calculated as shown in Table 8-2 (appended).

8-3. Revenue and Expenditure

8-3-1. Method of Calculation

The revenue was classified into the following six kinds according to the current method of classification of Banjarmasin Port and was calculated as set forth in the following respectively.

(1) Harbour dues:

Harbour due per ton of total cargoes (unit charge)
x Estimated total cargoes (see Section 3-5)

(2) Quay dues:

Quay due per ton of total cargoes (unit charge)
x Estimated total cargoes

(3) Equipment rental:

Equipment rental charge per ton of general cargo (unit charge)
x Estimated general cargo (see Section 3-5)

(4) Pilotage dues:

Pilotage due per ton of total cargoes (unit charge)
x Estimated total cargoes

(5) Support revenue:

Total amount of revenue estimated upon the past records

(6) Land rental:

Total amount of revenue estimated upon the past records

In principle, the unit charges associated with vessels should be correlated to the volume of vessels, and those associated with cargoes to the quantity of cargoes for the sake of calculation. But, there were not sufficient data available of the vessels. Thus, in consideration that the size of vessel would finally be proportional to the cargo volume, the revenues were correlated to the quantity of cargoes. In Banjarmasin Port, it was noted that harbour due, quay due and pilotage due were highly correlated to the total cargoes and that equipment rental charge was highly correlated to general cargo.

On the other hand, the expenditure was classified into the personnel expense, maintenance expense, administration expense, interest and depreciation. The personnel expense (1975, 200 persons; 1983, 500 persons; and 2000, 1000 persons, with the salary increase estimated at a rate of 5 percent per year), interest (refer to Section 8-2) and depreciation (refer to Section 8-2) were calculated by summing up. The maintenance and administration expenses were calculated by taking into consideration the actual operating ratios at Tg. Priok Port, etc.

With regard to net profit after depreciation, it was calculated that 30.25 percent of net profit was paid into the Central Government development fund as in the case of a government enterprise and that the remaining of net profit was reserved internally. The basis of calculation is:

(Net profit after depreciation 100% – Tax fund 45%) x 55% = 30.25%.

8-3-2. Self-paying and Levels of Unit Charge

Upon calculation of the revenues in the target years of Plan-I and Plan-II (or 1983 and 2000) standing on the basic concept to maintain a self-paying system based on the cost principle, the unit charges had to be raised considerably as shown in the following table. In the case of Banjarmasin Port, the investment is to be made in a scale approximately equal to that of a new port. Thus, in Plan-II, the burdens of the interest and depreciation were great enough to raise the unit charges in the target year of 2000 to average 5.4 times those in 1975. Further, from the concept of cost principle, the maintenance dredging expense of channel to be borne by the Central Government had to be reflected in the unit charges in their calculations so that the unit charges in the target year of Plan-I or 1983 had to be raised to average 3.5 times those in 1975.

	1975			1983			2000		
	Unit charge	Volume of cargoes	Revenue	Unit charge	Volume of cargoes	Revenue	Unit charge	Volume of cargoes	Revenue
	Rp/ton	1,000 tons	Rp. millions	Rp/ton	1,000 tons	Rp. millions	Rp/ton	1,000 tons	Rp. millions
Harbour Dues	32 (1)	1,186 (1)	37 (1)	154 (4.8)	2,810 (2.4)	430 (11.6)	214 (6.7)	7,540 (6.4)	1,610 (43.5)
Quay Dues	71 (1)	1,186 (1)	83 (1)	369 (5.2)	2,810 (2.4)	1,040 (12.5)	646 (9.1)	7,540 (6.4)	4,870 (58.7)
Equipment Rental	78 (1)	444 (1)	35 (1)	250 (3.2)	650 (1.5)	160 (4.6)	335 (4.3)	2,332 (5.3)	780 (22.3)
Pilotage Dues	68 (1)	1,186 (1)	80 (1)	245 (3.6)	2,810 (2.4)	690 (8.6)	347 (5.1)	7,540 (6.4)	2,620 (32.8)
Support Revenue			31 (1)			70 (2.3)			120 (3.9)
Land Rental			30 (1)			40 (1.3)			80 (2.7)
Total	(1)		296 (1)	(3.5)		2,430 (8.2)	(5.4)		10,080 (34.1)

Note: The parenthesized indicates a trend ratio.

In raising the unit charges in the years between said target years, a method of raising at the same rate every year was employed considering that the economic influences of the sharp rise of the charges should be reduced to minimum and the charges should be raised along with improvement of the service. As the result, the 5.4 times increase in 2000 was equivalent to an annual increase at a rate of 7 percent. Further, in assessing the respective charges, the unit charges associated with the vessels were raised at a high rate considering the large benefits of the vessels such as reduction of days of stay at anchorage, while the unit charges associated with the cargoes were kept at low.

As described in the foregoing, great are the burdens of the interest on loan and the depreciation in the case of a new port. Unless the charges of the new port are raised considerably as compared with the case of an existing port, the revenue and expenditure of the new port is often unpayable. Seen from such instance, the elevation at the annual rate of 7 percent of the unit charges over the period of 25 years may be considered to be reasonable as a target figure of long-term administration in order to keep the self-supporting accounting system. However, from the political standpoint to stabilize the prices and suppress the inflation, the elevation at the annual rate of 7 percent is likely to induce great influences and is hardly realizable. It is difficult to specifically assess the effects of the elevation of port charges on the rise of the commodity prices, yet the psychological effects are no longer negligible. Thus, while the foregoing standing on the self-paying system was taken as a standard as Case A, another case B suppressing the elevation of the unit charges upon the political standpoint of price stabilization was provided to carry out a sensitivity test.

Case A = Degree of elevation of the unit charge:
Increasing in a geometric ratio from 1 in 1975 to 3.5 in 1983 and 5.4 in 2000.

Case B = Degree of elevation of the unit charge:
Unchanging from 1975 to 1983, increased twice in 1984 and thereafter unchanging until 2000.

8-3-3. Tables of Revenue and Expenditure

Upon the change in the condition of loan and that in the degree of elevation of the unit charges as raised in Section 8-2 and Paragraph 8-3-2, the following four plans are conceivable as alternatives of the revenue and expenditure calculation.

Case	Conditions of loan in Stage-I	Elevation of unit charges
A–(a)	2%, 40 years	Increasing geometrically from 1 in 1975 to 3.5 in 1983 and 5.4 in 2000.
A–(b)	3%, 30 years	Same as above.
B–(a)	2%, 40 years	Unchanging in 1975-1983, increased by two times in 1984 and thereafter unchanging until 2000.
B–(b)	3%, 30 years	Same as above.

Now, the tables of revenue and expenditure will be prepared in three cases, the Case A-(a) which is of the best condition upon the self-paying standpoint, Case A-(b) and Case B-(b) which is of the worst condition upon the political standpoint. Those are Tables 8-3(1), 8-3(2), 8-4(1), 8-4(2), 8-5(1) and 8-5(2) (all appended). Principal figures are compared in the following.

(Rp. millions)

	Case	1977	1978	1979	1980	1981	1982	1983	2000
Revenue	A – (a)	470	630	830	1,080	1,430	1,860	2,430	10,080
	A – (b)	470	630	830	1,080	1,430	1,860	2,430	10,080
	B – (b)	340	380	410	450	510	560	610	3,320
Net Profit after Depreciation	A – (a)	90	150	190	270	350	440	600	780
	A – (b)	90	150	180	240	300	385	510	780
	B – (b)	– 40	–100	–240	–390	–620	–920	–1,310	– 5,980
Interest on Loans	(a)		7	30	60	90	140	180	2,270
	(b)		10	40	90	140	200	270	2,270
Depreciation		30	30	40	110	200	310	430	2,250

(Rp. millions)

	Case	1976~1983	1984~1988	1989~1993	1994~2000
Revenue	A – (a) A – (b) B – (b)	9,090 9,090 3,570	15,990 15,990 7,180	24,600 24,600 10,700	57,680 57,680 19,550
Net Profit after Depreciation	A – (a) A – (b) B – (b)	2,120 1,880 – 3,640	3,090 2,580 – 6,230	1,360 1,000 – 12,900	1,800 1,650 – 36,480
Interest on Loans	(a) (b)	510 750	1,030 1,540	5,560 5,920	13,420 13,570
Depreciation		1,180	3,920	6,910	13,840

As the result of the sensitivity test, it may be said 1) that the change of the conditions of loan in Stage-I has little influence upon the statue of revenue and expenditure, 2) that when the political position is taken under which the unit charges are pegged until 1983 then increased twice, there will be a loss of 1,300 million Rp in 1983 and 6,000 million Rp in 2000 and 3) that the greater part of the loss is due to the interest to be paid and the depreciation. Such amount in loss is very slight in the light of the current financial scale of the Indonesian Government, and it will not be difficult to make up for the loss through disbursement of a subsidy as an natural increase of the revenue is expectable hereafter. Thus, from the self-paying concept, it is preferable to raise the unit charges as scheduled in Case A, but if a policy to make up the loss through a financial support is taken, elevation in a great extent of the unit charges may be avoided.

8-4. D.C.F. Rate of Return

Next, the investment effect of Banjarmasin Port will now be seen from another angle. What rate of return is represented by the total of profits before depreciation before interest up to 2000 in Case A-(a) as calculated under the self-paying system against the total of investments up to 2000, will be seen. When the internal rate of return was calculated according to the following equation, it was given as 5.0 percent in Plan-I and 3.3 percent in Plan-II as shown in Table 8-6.

D.C.F. (Discounted Cash Flow) Rate of Return

$$= \frac{\text{Profit before Depreciation before Interest (Cash in Flow)}}{\text{Investment (Cash Out Flow)}}$$

These rates of return may be taken as reasonable figures from the viewpoint of the investment to infrastructures, but are not high figures from the level of the rates of return in the port investments in the developing countries. Thus, from D.C.F. rates of return, the level of the unit charges according to Case A-(a) is considered to be desirable. D.C.F. rate of return in Plan-II fell short of that in Plan-I as in the case of the internal rates of return in the economic analyses, but they are not comparable simply for discussion of which is better (refer to Section 7-5).

8-5. Balance Sheet at End of Year

Currently, Banjarmasin Port is preparing the balance sheet including the assets and liabilities of the ports belonging to the Fifth District. Thus, upon the figures at the end of 1975, the balance sheet of Banjarmasin Port alone in 1975 was prepared (appended Table 8-9). Then, from this provisional balance sheet and Tables 8-1, 8-2, 8-3(1) and 8-3(2), tables of the source and application of funds (appended Tables 8-7 and 8-8) and the balance sheets (appended Table 8-9) were prepared for Case A-(a). The net current assets listed in the balance sheet were calculated according to the following definition.

Net Current Assets = Current Assets - Current Liabilities

Further, there were calculated the operating ratios from Tables 8-3(1) and 8-3(2), and were calculated the returns on net fixed assets from Tables 8-3(1), 8-3(2) and 8-9, which were listed at the bottom of Table 8-9.

$$\text{Operating Ratio} = \frac{\text{Operating Expenditure}}{\text{Operating Revenue}} \times 100$$

Return on Net Fixed Assets

$$= \frac{\text{Profit after Depreciation before Interest}}{\text{Net Fixed Assets at End of Year}} \times 100$$

The following summaries may be made from the balance sheets for Case A-(a):

(1) In Stage-II when the investment effects are developed, the net current assets increase to 10 percent or more in the proportion to the total assets and the liquidity of financial positions is considerably improved.

(2) With increasing depreciation, the operating ratio and the return on net fixed assets may be degraded in Stage-II but be improved gradually to the level of the operating ratio at 70 percent and the return on net fixed assets at 3.8 percent in 2000.

(3) The rate of return on net fixed assets at 3.8 percent is, similarly to D.C.F. rate of return described in Section 8-4, not of a high level but is a tolerable figure considering that the investment of Banjarmasin Port is made in a scale approximately equal to that of constructing a new port.

If the loss in balance in Case B-(b) is filled up by the government subsidy, the figures in the tables of the source and application of funds and in the balance sheet are to change as given below depending on the case.

Source & Application of Funds

(Rp. millions)

	Case	1977	1978	1979	1980	1981	1982	1983	1976 ~1983	1984 ~1988	1989 ~1993	1994 ~2000
Profit before Depreciation	A-(a)	120	180	230	380	550	750	1,030	3,300	7,010	8,270	15,640
	A-(b)	120	180	220	350	500	690	940	3,060	6,500	7,910	15,490
	B-(b)	30	30	40	110	200	310	430	1,180	3,920	6,910	13,840
Repayment of Long-term Loans	A-(a)									340	4,840	12,400
	A-(b)									520	5,700	13,600
	B-(b)									520	5,700	13,600
Payment to Government	A-(a)	30	50	60	80	110	130	180	650	930	410	540
	A-(b)	30	50	50	70	90	110	150	560	780	300	500
	B-(b)											
Increase/Decrease of Net Current Assets	A-(a)	20	130	170	300	440	620	850	2,520	5,740	3,020	2,700
	A-(b)	20	130	170	280	410	580	790	2,370	5,200	1,910	1,390
	B-(b)	- 40	30	40	110	200	310	430	1,050	3,400	1,210	240

Balance Sheet at End of Year

(Rp. millions)

	Case	1977	1978	1979	1980	1981	1982	1983	1988	1993	2000
Net Current Assets	A-(a)	230	360	530	830	1,270	1,890	2,740	8,480	11,500	14,200
	A-(b)	230	360	530	810	1,220	1,800	2,590	7,790	9,700	11,090
	B-(b)	150	180	220	330	530	840	1,270	4,670	5,880	6,120
Other Reserves and Provisions	A-(a)	420	520	650	840	1,080	1,390	1,810	3,970	4,920	6,180
	A-(b)	420	520	650	820	1,030	1,300	1,660	3,460	4,160	5,310
	B-(b)	340	340	340	340	340	340	340	340	340	340
Long-term Loans	A-(a)		700	2,200	3,700	5,700	7,900	10,300	22,460	30,120	35,220
	A-(b)		700	2,200	3,700	5,700	7,900	10,300	22,280	29,080	32,980
	B-(b)		700	2,200	3,700	5,700	7,900	10,300	22,280	29,080	32,980
Total Assets	A-(a)	1,170	2,670	5,920	9,260	13,750	18,670	24,230	54,920	82,890	120,530
	A-(b)	1,170	2,670	5,920	9,240	13,700	18,580	24,080	54,230	81,090	117,420
	B-(b)	1,090	2,490	5,610	8,760	13,010	17,620	22,760	51,110	77,270	112,450

Now looking at the change in the balance sheet. In Case A-(b), it takes the form of decrease in the net current assets and in the other reserves and provisions corresponding to the increment in the interest payable and in the repayment of long-term loans as compared with Case A-(a). In Case B-(b), it takes the form of the net current assets increasing every year by an amount deducting the repayment of long-term loans from the depreciation while the other reserves and provisions being not.

As stated in Paragraph 8-3-3, the loss in balance in Case B-(b) is in an amount that can be filled up by the government subsidy when the financial scale is taken into account. Accordingly, in any of Cases A-(a), A-(b) and B-(b), financial viability is observed.

Table 8–1 *Long-term Loan Schedule (Rp. millions)*

	Investment			Case (a)			Case (b)		
	Development Fund	Long-term Loans (or Credits)	Total	Loans Repayment Amount	Loans Balance at End	Loans Interest, Credits Charge	Loans Repayment Amount	Loans Blance at End	Loans Interest, Credits Charge
1978	670	700	1,370		700	7		700	10
1979	1,580	1,500	3,080		2,200	30		2,200	40
1980	1,540	1,500	3,040		3,700	60		3,700	90
1981	2,050	2,000	4,050		5,700	90		5,700	140
1982	2,100	2,200	4,300		7,900	140		7,900	200
1983	2,310	2,400	4,710		10,300	180		10,300	270
			(annual 4,990)						
1984 – 1988	12,450	12,500	24,950	340	22,460	1,030	520	22,280	1,540
1989 – 1993	12,450	12,500	24,950	4,840	30,120	5,560	5,700	29,080	5,920
1994 – 2000	17,440	17,500	34,940	12,400	35,220	13,420	13,600	32,980	13,570

Table 8-2 Fixed Assets Schedule (Rp. millions)

	Addition Fixed Assets to be Depreciated	Depreciation	Net Fixed Assets to be Depreciated at End	Addition Land	Net Fixed Assets at End	Fixed Assets at End
(1975)			(520)		(630)	(810)
1976	60	30	550		660	870
1977	70	30	590		700	940
1978	280	30	840	1,090	2,040	2,310
1979	2,240	40	3,040	840	5,080	5,390
1980	2,730	110	5,660	310	8,010	8,430
1981	3,720	200	9,180	330	11,860	12,480
1982	3,970	310	12,840	330	15,850	16,780
1983	3,530	430	15,940	1,180	20,130	21,490
1984 – 1988	23,300	3,920	35,320	1,650	41,160	46,440
1989 – 1993	23,300	6,910	51,710	1,650	59,200	71,390
1994 – 2000	32,720	13,840	70,590	2,220	80,300	106,330

Table 8-3 (1) Plan I: Statement of Revenue & Expenditure (Case A–(a)) (Rp. millions)

	1976	1977	1978	1979	1980	1981	1982	1983
Revenue								
Harbour Dues	50	70	100	130	180	260	330	430
Quay Dues	110	160	220	300	410	550	760	1,040
Equipment Rental	40	50	60	80	90	110	130	160
Pilotage Dues	110	140	180	240	310	410	530	690
Support Revenue	30	30	40	50	60	60	70	70
Land Rental	20	20	30	30	30	40	40	40
Total	360	470	630	830	1,080	1,430	1,860	2,430
Expenditure								
Official Cost	100	110	140	170	190	220	270	330
Maintenance Cost	120	150	190	250	290	370	460	580
Administration Cost	80	90	110	150	160	200	240	310
Interest on Loans			7	30	60	90	140	180
Total	300	350	447	600	700	880	1,110	1,400
Profit before Depreciation	60	120	180	230	380	550	750	1,030
Less Depreciation	30	30	30	40	110	200	310	430
Net Profit after Depreciation	30	90	150	190	270	350	440	600
Less Payment to Government Development Reserve	10	30	50	60	80	110	130	180
Net Profit to Port	20	60	100	130	190	240	310	420
Accumulated Net Profit to Port from 1976	20	80	180	310	500	740	1,050	1,470

Table 8-3 (2) Plan II: Statement of Revenue & Expenditure (Case A– (a)) (Rp. millions)

	1976 - 1983 (8 years)	1984 - 1988 (5 years)	1989 - 1993 (5 years)	1994 - 2000 (7 years)	Annual 1976	Annual 1983	Annual 2000
Revenue							
Harbour Dues	1,550	2,800	4,280	9,700	50	430	1,610
Quay Dues	3,550	6,930	11,050	27,050	110	1,040	4,870
Equipment Rental	720	1,070	1,710	4,210	40	160	780
Pilotage Dues	2,610	4,460	6,750	15,430	110	690	2,620
Support Revenue	410	460	500	770	30	70	120
Land Rental	250	270	310	520	20	40	80
Total	9,090	15,990	24,600	57,680	360	2,430	10,080
Expenditure							
Official Cost	1,530	2,240	3,150	8,940	100	330	1,520
Maintenance Cost	2,410	3,770	5,200	13,350	120	580	2,220
Administration Cost	1,340	1,940	2,420	6,330	80	310	1,040
Interest on Loans	510	1,030	5,560	13,420		180	2,270
Total	5,790	8,980	16,330	42,040	300	1,400	7,050
Profit before Depreciation	3,300	7,010	8,270	15,640	60	1,030	3,030
Less Depreciation	1,180	3,920	6,910	13,840	30	430	2,250
Net Profit after Depreciation	2,120	3,090	1,360	1,800	30	600	780
Less Payment to Government Development Reserve	650	930	410	540	10	180	240
Net Profit to Port	1,470	2,160	950	1,260	20	420	540
Accumulated Net Profit to Port from 1976	1,470	3,630	4,580	5,840	20	1,470	5,840

Table 8-4 (1) Plan I: Statement of Revenue & Expenditure (Case A–(b)) (Rp. millions)

	1976	1977	1978	1979	1980	1981	1982	1983
Revenue								
Harbour Dues	50	70	100	130	180	260	330	430
Quay Dues	110	160	220	300	410	550	760	1,040
Equipment Rental	40	50	60	80	90	110	130	160
Pilotage Dues	110	140	180	240	310	410	530	690
Support Revenue	30	30	40	50	60	60	70	70
Land Rental	20	20	30	30	30	40	40	40
Total	360	470	630	830	1,080	1,430	1,860	2,430
Expenditure								
Official Cost	100	110	140	170	190	220	270	330
Maintenance Cost	120	150	190	250	290	370	460	580
Administration Cost	80	90	110	150	160	200	240	310
Interest on Loans			10	40	90	140	200	270
Total	300	350	450	610	730	930	1,170	1,490
Profit before Depreciation	60	120	180	220	350	500	690	940
Less Depreciation	30	30	30	40	110	200	310	430
Net Profit after Depreciation	30	90	150	180	240	300	380	510
Less Payment to Government Development Reserve	10	30	50	50	70	90	110	150
Net Profit to Port	20	60	100	130	170	210	270	360
Accumulated Net Profit to Port from 1976	20	80	180	310	480	690	960	1,320

Table 8-4 (2) Plan II: Statement of Revenue & Expenditure (Case A– (b)) (Rp. millions)

	1976 - 1983 (8 years)	1984 - 1988 (5 years)	1989 - 1993 (5 years)	1994 - 2000 (7 years)	Annual		
					1976	1983	2000
Revenue							
Harbour Dues	1,550	2,800	4,280	9,700	50	430	1,610
Quay Dues	3,550	6,930	11,050	27,050	110	1,040	4,870
Equipment Rental	720	1,070	1,710	4,210	40	160	780
Pilotage Dues	2,610	4,460	6,750	15,430	110	690	2,620
Support Revenue	410	460	500	770	30	70	120
Land Rental	250	270	310	520	20	40	80
Total	9,090	15,990	24,600	57,680	360	2,430	10,080
Expenditure							
Official Cost	1,530	2,240	3,150	8,940	100	330	1,520
Maintenance Cost	2,410	3,770	5,200	13,350	120	580	2,220
Administration Cost	1,340	1,940	2,420	6,330	80	310	1,040
Interest on Loans	750	1,540	5,920	13,570		270	2,270
Total	6,030	9,490	16,690	42,190	300	1,490	7,050
Profit before Depreciation	3,060	6,500	7,910	15,490	60	940	3,030
Less Depreciation	1,180	3,920	6,910	13,840	30	430	2,250
Net Profit after Depreciation	1,880	2,580	1,000	1,650	30	510	780
Less Payment to Government Development Reserve	560	780	300	500	10	150	240
Net Profit to Port	1,320	1,800	700	1,150	20	360	540
Accumulated Net Profit to Port from 1976	1,320	3,120	3,820	4,970	20	1,320	4,970

Table 8-5 (1) Plan I: Statement of Revenue & Expenditure (Case B–(b)) (Rp. millions)

	1976	1977	1978	1979	1980	1981	1982	1983
Revenue								
Harbour Dues	40	50	50	60	60	70	80	90
Quay Dues	90	100	120	130	140	160	180	200
Equipment Rental	40	40	40	40	40	50	50	50
Pilotage Dues	90	100	110	120	140	150	170	190
Support Revenue	30	30	30	30	40	40	40	40
Land Rental	20	20	30	30	30	40	40	40
Total	310	340	380	410	450	510	560	610
Expenditure								
Official Cost	100	110	140	170	190	220	270	330
Maintenance Cost	120	150	190	250	290	370	460	580
Administration Cost	80	90	110	150	160	200	240	310
Interest on Loans			10	40	90	140	200	270
Total	300	350	450	610	730	930	1,170	1,490
Profit before Depreciation	10	–10	–70	–200	–280	–420	–610	–880
Less Depreciation	30	30	30	40	110	200	310	430
Net Profit after Depreciation	–20	–40	–100	–240	–390	–620	–920	–1,310
Less Payment to Government Development Reserve								
Net Profit to Port	–20	–40	–100	–240	–390	–620	–920	–1,310
Accumulated Net Profit to Port from 1976	–20	–60	–160	–400	–790	–1,410	–2,330	–3,640

Table 8-5 (2) Plan II: Statement of Revenue & Expenditure (Case B- (b)) (Rp. millions)

	1976 - 1983 (8 years)	1984 - 1988 (5 years)	1989 - 1993 (5 years)	1994 - 2000 (7 years)	Annual 1976	1983	2000
Revenue							
Harbour Dues	500	1,070	1,440	2,860	40	90	480
Quay Dues	1,120	2,380	4,190	6,350	90	200	1,070
Equipment Rental	350	650	940	2,050	40	50	360
Pilotage Dues	1,070	2,290	3,060	6,080	90	190	1,030
Support Revenue	280	520	760	1,690	30	40	300
Land Rental	250	270	310	520	20	40	80
Total	3,570	7,180	10,700	19,550	310	610	3,320
Expenditure							
Official Cost	1,530	2,240	3,150	8,940	100	330	1,520
Maintenance Cost	2,410	3,770	5,200	13,350	120	580	2,220
Administration Cost	1,340	1,940	2,420	6,330	80	310	1,040
Interest on Loans	750	1,540	5,920	13,570		270	2,270
Total	6,030	9,490	16,690	42,190	300	1,490	7,050
Profit before Depreciation	–2,460	–2,310	–5,990	–22,640	10	–880	–3,730
Less Depreciation	1,180	3,920	6,910	13,840	30	430	2,250
Net Profit after Depreciation	–3,640	–6,230	–12,900	–36,480	–20	–1,310	–5,980
Less Payment to Government Development Reserve							
Net Profit to Port	–3,640	–6,230	–12,900	–36,480	–20	–1,310	–5,980
Accumulated Net Profit to Port from 1976	–3,640	–9,870	–22,770	–59,250	–20	–3,640	–59,250

Table 8-6 D.C.F. Rate of Return (Rp. millions)

		Plan I				Plan II			
		Cash Out Flow	Cash In Flow	Discounted Value (5%)		Cash Out Flow	Cash In Flow	Discounted Value (3%)	
				Cash Out Flow	Cash In Flow			Cash Out Flow	Cash In Flow
1	1976								
2	1977								
3	1978	1,370	190	1,243	172	1,370	190	1,291	179
4	1979	3,080	260	2,661	225	3,080	260	2,819	238
5	1980	3,040	440	2,501	362	3,040	440	2,701	391
6	1981	4,050	640	3,173	501	4,050	640	3,494	552
7	1982	4,300	890	3,209	664	4,300	890	3,601	745
8	1983	4,710	1,210	3,347	860	4,710	1,210	3,830	984
9	1984		1,210		819	4,990	1,320	3,939	1,042
10	1985		1,210		780	4,990	1,440	3,824	1,104
11	1986		1,210		743	4,990	1,570	3,713	1,168
12	1987		1,210		707	4,990	1,710	3,605	1,235
13	1988		1,210		674	4,990	1,870	3,500	1,312
14	1989		1,210		642	4,990	2,040	3,398	1,389
15	1990		1,210		611	4,990	2,230	3,299	1,474
16	1991		1,210		582	4,990	2,430	3,203	1,560
17	1992		1,210		554	4,990	2,650	3,110	1,651
18	1993		1,210		528	4,990	2,890	3,019	1,748
19	1994		1,210		503	4,990	3,150	2,931	1,850
20	1995		1,210		479	4,990	3,440	2,846	1,962
21	1996		1,210		456	4,990	3,750	2,763	2,076
22	1997		1,210		434	4,990	4,100	2,682	2,204
23	1998		1,210		414	4,990	4,470	2,604	2,333
24	1999		1,210		394	4,990	4,880	2,528	2,473
25	2000		1,210		375	5,000	5,300	2,460	2,607
26	2001		1,210		357		5,300		2,531
27	2002		1,210		340		5,300		2,458
28	2003		1,210		324		5,300		2,386
29	2004		1,210		309		5,300		2,317
30	2005		1,210		294		5,300		2,249
Residual Value			8,550		2,077		68,650		29,128
Total		20,550	38,800	16,134	16,180	105,390	148,020	71,160	73,346

D.C.F.R.R. = 5.0%

D.C.F.R.R. = 3.3%

Table 8-7 Plan I: Source & Application of Funds (Rp. millions)

	1976	1977	1978	1979	1980	1981	1982	1983
Source of Funds (A)								
Profit before Depreciation	60	120	180	230	380	550	750	1,030
Proceeds from Long-term Loans			700	1,500	1,500	2,000	2,200	2,400
Government Development Fund			670	1,580	1,540	2,050	2,100	2,310
Total	60	120	1,550	3,310	3,420	4,600	5,050	5,740
Application of Funds (B)								
Cost of Fixed Assets Additions	60	70	1,370	3,080	3,040	4,050	4,300	4,710
Repayment of Long-term Loans								
Payment to Government	10	30	50	60	80	110	130	180
Total	70	100	1,420	3,140	3,120	4,160	4,430	4,890
Increase/Decrease (–) of Net Current Assets (C = A – B)	–10	20	130	170	300	440	620	850
Net Current Assets at Beginning of Year (D)	220	210	230	360	530	830	1,270	1,890
Net Current Assets at End of Year (C + D)	210	230	360	530	830	1,270	1,890	2,740

Table 8-8 Plan II: Source & Application of Funds (Rp. millions)

	1976 – 1983 (8 years)	1984 – 1988 (5 years)	1989 – 1993 (5 years)	1994 – 2000 (7 years)
Source of Funds (A)				
Profit before Depreciation	3,300	7,010	8,270	15,640
Proceeds from Long-term Loans	10,300	12,500	12,500	17,500
Government Development Fund	10,250	12,450	12,450	17,440
Total	23,850	31,960	33,220	50,580
Application of Funds (B)				
Cost of Fixed Assets Additions	20,680	24,950	24,950	34,940
Repayment of Long-term Loans		340	4,840	12,400
Payment to Government	650	930	410	540
Total	21,330	26,220	30,200	47,880
Increase/Decrease (–) of Net Current Assets (C = A–B)	2,520	5,740	3,020	2,700
Net Current Assets at Beginning of Year (D)	220	2,740	8,480	11,500
Net Current Assets at End of Year (C + D)	2,740	8,480	11,500	14,200

Table 8-9 Balance Sheet at End of Year (Rp. millions)

	(1975)	1976	1977	1978	1979	1980	1981	1982	1983	1988	1993	2000
Assets												
Fixed Assets	810	870	940	2,310	5,390	8,430	12,480	16,780	21,490	46,440	71,390	106,330
(contained Land)	(110)	(110)	(110)	(1,200)	(2,040)	(2,350)	(2,680)	(3,010)	(4,190)	(5,840)	(7,490)	(9,710)
Net Current Assets	220	210	230	360	530	830	1,270	1,890	2,740	8,480	11,500	14,200
Total	1,030	1,080	1,170	2,670	5,920	9,260	13,750	18,670	24,230	54,920	82,890	120,530
Liabilities												
Capital	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Other Reserves and Provision	340	360	420	520	650	840	1,080	1,390	1,810	3,970	4,920	6,180
Long-term Loans				700	2,200	3,700	5,700	7,900	10,300	22,460	30,120	35,220
Government Development Fund	510	510	510	1,180	2,760	4,300	6,350	8,450	10,760	23,210	35,660	53,100
Accumulated Depreciation on Fixed Assets	180	210	240	270	310	420	620	930	1,360	5,280	12,190	26,030
Total	1,030	1,080	1,170	2,670	5,920	9,260	13,750	18,670	24,230	54,920	82,890	120,530

Operating Ratio (%)		91.7	80.9	74.6	73.5	69.4	69.2	68.8	67.9	78.1	74.4	69.7
Return on Net Fixed Assets (%)		4.55	12.86	7.70	4.33	4.12	3.71	3.66	3.87	1.97	2.43	3.80

Chapter-9

Port Administration and Operation

CHAPTER 9
PORT ADMINISTRATION AND OPERATION

9-1. Introduction

Before completion of the access channel at the Barito River mouth, Banjarmasin Port had been handling logs for foreign trade. But, the logs loading had to be carried out in open sea about 40 kilometers apart from the port, and in this regard, it was a domestic trade port in character.

As the development of Banjarmasin Port progresses, there will be an increasing port cargo and also an increasing demand for port so that the port will have its character as a foreign trade port intensified. In prospect of such future of Banjarmasin Port, the port administration and operation as well as organization will be examined in the following in this chapter.

9-2. Present Situation

The foreign trade ports in Indonesia are operated under the control of the Port Administrator installed in the respective ports under the direction and support of the District Commander (or KEDAPEL) by order of the Director General of Sea Communications.

The District Commander directs and supervises the shipping administration including the port administration within the area of jurisdiction and is responsible for the administration so far as it is confined in the area of jurisdiction. The S.R. 5 District Commander (or KEDAPEL) installed in Banjarmasin City is responsible for the shipping administration in general in the water areas of South-East Kalimantan and Central Kalimantan including the channel up to the port.

Indonesia is divided into nine shipping regions, and each region is placed under the control of the District Commander concerned. The primary duty of the District Commander is to cooperate and coordinate with the government organs and other organizations concerned in execution of the shipping administration in general including the port administration and operation and thus to inspect and control the execution.

The shipping administration in West Kalimantan is conducted by the S.R. 3 District Commander stationed in Tg. Priok Port (or KEDAPEL-Tg. Triok).

Banjarmasin Port is placed under the control of the Port Administrator of Banjarmasin who administers the development and maintenance as well as day-to-day operation of the port. The Banjarmasin Port Administration is presently of the organization illustrated in Figure 9-1 and administers mainly the following works:

(1) Allocation of berths, and control of incoming and outgoing vessels
(2) Supervision and coordination of the use of labor and cargo handling equipment relative to port operation
(3) Technical works concerning construction, improvement and maintenance of the port
(4) Dredging

(5) Pilotage and ship/shore communications
(6) Administration of port activities
(7) Preparation for port statistics
(8) Financial operation and budgetary control of the port
(9) Collection and control of port dues and charges
(10) Security in the port area

In the Banjarmasin Port Administration, the foregoing works are allotted to and assumed by the following divisions:

Secretariat
Traffic Division
Service Division
Pilotage Division
Financial Division
Technical Division

The Banjarmasin Port Administration is also controlling the following local ports:

Pulang Pisau Port (Central Kalimantan)
Sampit Port (Central Kalimantan)
Samuda Port (Central Kalimantan)
Kumai Port (Central Kalimantan)
Sukamara Port (Central Kalimantan)
Pangkalanbun Port (Central Kalimantan)
K. Pembuang Port (Central Kalimantan)
K. Kapuas Port (Central Kalimantan)
Kotabaru Port (South Kalimantan)
Nunukan Port (East Kalimantan)
Tarakan Port (East Kalimantan)

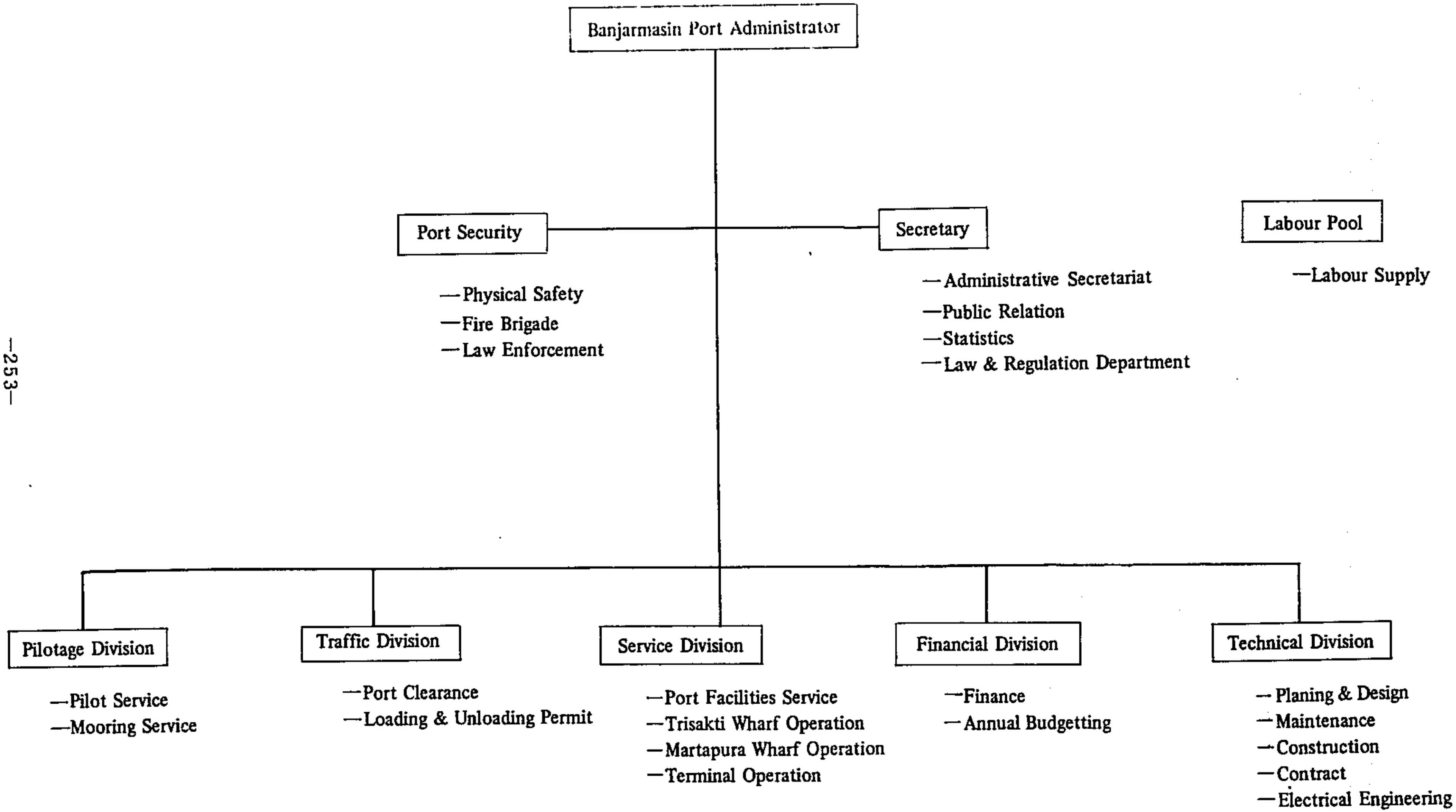
9-3. Recommendation on Administration and Operation

As Banjarmasin Port is expanded and improved, it will come to keep a close relation with the regional economic activities, resulting in an increasing demand for the port. Then, Banjarmasin Port will come out of the traditional domestic trade port into a foreign trade port with an increasing weight of handling of export and import cargoes. The activities of a port associated with the international trade are not only concerned with the economic activities in its service area but contribute to the economic activities in the country level, and in such condition, the port is no longer a minor but a major port in the character.

Thus, it will be required, while the development is expedited, to expand and strengthen the administration and operation system of Banjarmasin Port after the administration and operation systems of the other important ports of Indonesia such as Tg. Priok and Surabaya Ports engaged in the foreign trade.

As Banjarmasin Port develops into a foreign trade port, there will be an increasing volume of foreign trade cargoes. With such increase in the handling volume of cargoes, not only the work load will increase as compared with that at the time of handling only

Fig. 9-1 Present Organization of Banjarmasin Port Administration



the domestic trade cargoes, but the works incident to foreign trade such as control of bonded goods will have to be added. Further, as the port activities are directly connected with the national economy, more just and stricter administration and operation will be required. It will not be necessary to note that the port functions should always be kept at the highest level through adequate operation of the port.

What is to be noted in managing the port may be reduced to the following three points: (1) Nonprofit management of the port should be maintained; (2) Preferably the port is not managed politically; and (3) In management of the port, efforts should be exerted so that the port has a financial independency.

Generally, the port plays an important role in the transportation and communication through movement of the commodities, and on the other hand, it serves as an industrial base or a living base in the case of a fishing port and is thus, as an infrastructure, highly public in character. Particularly, in the case of a port directly connected with the activities of the national economy, maintenance of the publicity is of great significance. Where anything like a profit is produced out of the port management, it should be given back to the local inhabitants.

Usually, the port has a diversity in the function and is operated with complex elements entangled with one another. It is by no means desirable that the port administration and operation are exposed to political transactions or influences.

Next, it should be noted that the maintenance of financial independency leads directly to non-political management of the port. The port administrator should try to finance the operating expenditure with the operating revenue, not counting the expenses required for construction works. The investment expenditure for, say, construction of a wharf or erection of a pier, may be defrayed from the taxes, if the socioeconomic effects of the port onto the service area are taken into consideration. Except such expenditure, the operating expenses are preferably financed, on the principle of the users bearing the costs, by the operating revenues such as port charges.

For administration and operation of Banjarmasin Port upon the consideration stated in the foregoing, it is urgently required to review the current system of organization and expand and reinforce the same or, more specifically, Service Division and Financial Division.

Further, the Banjarmasin Port Administration should add to their duties the administrative work required for promotion of the foreign trade as well as the labor management work designed for planned supply and maintenance of the port labor force, shore radio service indispensable for maintenance of close communication with the incoming or outgoing vessels, sailing boat quay management service in consideration of the speciality of the sailing boats, and aid-to-navigation and channel maintenance service, with the organization revised accordingly.

The divisions of the Port Administration that are to be expanded and reinforced are specifically listed in the following.

Traffic Division

It is required to integrate the current work of controlling the incoming and outgoing vessels and that of controlling the loading and unloading of Traffic Division into the terminal traffic control service and sea traffic control service, to define the scope of responsibility and particulars of the respective services and to increase the personnel in order to cope with the increasing foreign trade cargoes and incoming ocean going vessels. Further, for adequate assignment of the port labourers supplied from Labour Pool to the wharf according to a plan so that they will display their capacity fully to comply with the loading requirements, an organization responsible for labour allocation and supervision should be provided.

Unless the port labour force is supplied and assigned appropriately, not only the loading capacity is retarded but the port functions are impeded greatly.

The incoming and outgoing vessel control work and shoring and berth allocation work are preferably included in the sea traffic control service.

Traffic Division thus expanded and improved administers the following works.

Traffic Division
- Terminal Traffic Control
- Séa Traffic Control
- Labour Allocation and Supervision

Pilotage Division

Pilotage of the access channel extending over 40 kilometers is an important work not only as an aid-to-navigation service but for maintenance of the channel and smooth utilization of Banjarmasin Port. For performance of the pilotage service and berth allocation service, close communication with the incoming vessels is required. Then, it is desired to reinforce and improve the vessel communication and coastal telecommunication services, with the command system concentrated to the Port Administrator.

The work concerning the mooring service now assigned to Pilotage Division should be transferred to Port Service Division to integrate the service works for convenience of the users.

Maintenance of vessels and machines used in the pilotage service such as the pilot boats should be incorporated into Pilotage Division for clarification of the scope of responsibility.

Pilotage Division with new works incorporated is represented as given below.

Pilotage Division
- Pilotage Service
- Equipment Maintenance
- Coastal Telecommunication

Port Service Division

Improvement of the port service is prerequisite for securing the port revenue and maintaining the financial independence which is a requirement for proper administration and operation of the port. The ports being governed by the competitive principle, any port having the service degraded will not attract vessels. In consequence, such port will have the revenue decreased sharply, be desolated and come to lose its raison d'etre. The scope of the role which Port Service Division plays in maintenance and improvement of the port functions is very wide, and its responsibility is very great.

The scope of the works assigned currently to Service Division is covered, as a rule, satisfactorily. But, there is some ambiguous aspect with respect to the sharing and scope of responsibility with some overlapping observed. The works should be rearranged and classified according to the type of port activity.

The port facility services vary with the objective facility so that they should be rearranged and be defined clearly. The work should be classified into the services by type of the facilities such as mooring facility, shed, warehouse, open storage, power supply and water supply and the dock road maintenance service so that the services are offered properly.

The mooring service assigned to Pilotage Division is preferably transferred to Port Service Division from the point of view that it will be convenient for the users to integrate the services into one division and that operational advantages are expectable.

The current operation work of Martapura Wharf should be continued until it is transferred to Trisakti area sailing boat wharf to be constructed in Plan-II, and after transfer, it should be shifted to the sailing boat wharf operation to suit to the speciality. The works of the reorganized Port Service Division are set forth in the following.

Port Service Division
- Quay Service
- Shed/Storage Service
- Water/Electricity Supply
- Land Leasing
- Dock Road Service
- Port Equipment Service and Tariff
- Mooring Service
- Sailing Wharf Operation

Financial Division

With expansion of the port facilities along with progress of the port development, there will be required the work of maintenance and control of the facilities in addition to the work of port administration and operation so that the budget is diversified with its scale enlarged on one hand, and as the port activities become active, there will be an increasing port revenue so that the volume of accounting to be processed will increase on the other.

The work of Financial Division divided largely into two categories of finance and accounting so far and also the scope of the work should be reviewed and be rearranged into three independent duties of financial administration, budgetting and accounting with the scope of responsibility of the respective duties defined clearly for improvement of the efficiency in performing the duties.

Financial Division ─┬─ Financial Administration
├─ Accounting
└─ Budgetting

Technical Division

Where a port construction work is executed, Technical Division is responsible for all works concerning the technology so that it functions as the center of port development and serves as a substantial parent body in the execution. For smooth fulfilment of the work and clear representation of the scope of responsibility, it will be required to rearrange the current work duties. For this, it is desirable to classify the work according to what is actually carried out. Such classification should comprise at least the port planning, civil engineering, mechanical/electrical engineering and facility maintenance (except maintenance dredging of the channel).

Technical Division ─┬─ Planning
├─ Civil Engineering
├─ Mechanical/Electrical Engineering
└─ Maintenance

Channel Maintenance Division

Banjarmasin Port has a lengthy access channel extending for about 40 kilometers, and since any other substitute channel is not obtainable from the geographical features, it is required to exercise intensive control of the incoming and outgoing vessels along the channel, and the port functions are dependent greatly on how the channel maintenance and control are exercised. The channel maintenance is thus a very important work vital to the operation of Banjarmasin Port and is by no means treated as a side work of any other division.

The work required to insure satisfactory maintenance of the access channel includes:

(1) To conduct periodic surveys of the channel to grasp the exact condition of siltation of the channel;
(2) To formulate an effective and economic plan for maintenance dredging upon analysis of the results of surveys;
(3) To support the maintenance dredging work to insure its smooth performance; and
(4) To provide necessary aids-to-navigation to support and insure safety of the vessels navigating the channel, and maintain and control such aid facilities.

For the foregoing work to be assigned properly and the responsibility for the work to be established clearly, it is required, from the qualitative as well as quantitative aspect of the work, to create Channel Maintenance Division in the Banjarmasin Port Administration.

The duties of Channel Maintenance Division proposed here are summarized as follows.

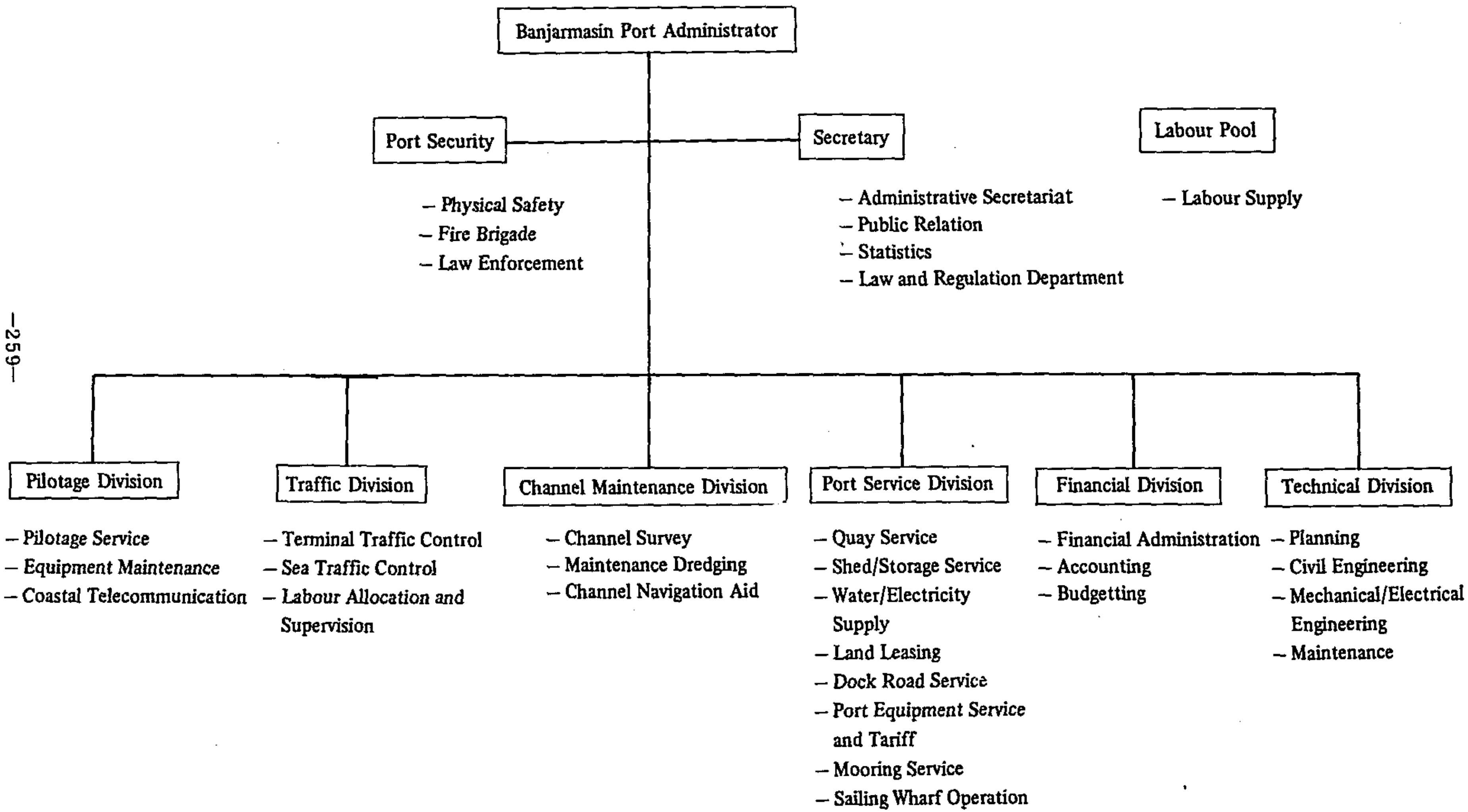
Channel Maintenance Division
- Channel Survey
- Maintenance Dredging
- Channel Navigation Aid

Organization of Standing Committee and Liaison Conference

In the so-called development ports which are to be developed from now on as in the case of Banjarmasin Port, or in the ports which are already of a substantial scale, the port administrator should normally maintain a channel through which he will be able to hear comments on the development of the urban area to which his port belongs or to hear desires for the administration and operation of his port. Further, it is also important for him to have a forum in which he will be able to exchange opinions candidly with the personnel concerned of the District Development Office (BAPEDA), Local Government and City Board.

It will then be desirable to provide a standing committee with members composed of the chiefs of the development organizations and men of knowledge and experience including Governor and Mayor, and to provide a liaison conference of the responsible persons of the organizations concerned.

Fig. 9-2 Proposed Organization Structure of Banjarmasin Port Administration



Chapter-10

Environmental Assessment

CHAPTER 10

ENVIRONMENTAL ASSESSMENT

10-1. Introduction

Having always a recognition that the natural environment on the globe is a fortune given to us human beings, we should wrestle with a development project. A development enterprise will bring more or less modifications of the nature do not result in destroying the nature.

In the case of the development of Banjarmasin Port with an object of a local development, a natural water front will be altered into a wharves while a lower and moist land which has been always flooded will be reclaimed to be an industrial land. As the development advances, Banjarmasin City will enlarge. with many loads being constructed on a wilderness and many dwellings being built around them.

On the other hand, the water channel of the Barito river will be dredged so as to assure the safety navigations of large ships therethrough, but this would result to delicate changes of the flows of the river. Hence the planning should be established so as these modifications of the natural configuration not to cause serious destructions on the natural environment. Furthermore, in developing industries, a consideration should be drawn to exhausted smokes, exhausted water, wasted liquids or dust from raw materials being carried in, all of which are generated by the industrial operations, and if there would be any possibility that these matters should bring hazards on human lives as well as they should destroy or pollute the environment therearound, attention will have to be drawn to them during the steps of the planning.

However, it is a great misunderstanding to consider that the industrial development shall not be taken because it has a possibility to destroy the environment. We here suggest that it should be worth getting a sufficient benifit to develop ports and industries for advancing the local development eventhough the required countermeasures for public nuisances taken for it.

10-2. Air Pollution

Among lumber industries which have been already located in the project site concerned and are expected to perform main roles according as the development advances, the sawing industry will not cause a considerable trouble, but the plywood industry and the pulp industry will be apt to generate bed smell smokes or stimulant gases, while the chip stock yard of the chip industry will be apt to generate a bad smell gas and a methane combustible.

Since the buffer green belt with a sufficient width is planning between the industrial area and the city development area and since the almost lumber industries tend to be located along the side of the Barito River, it is unthinkable that the located industries would impaire seriously the lives of the citizens in future. Yet, for make assurance, it is necessary that the enterprise sides should lead to take sufficient air pollution countermeasures and offer financial aids, too.

It is difficult to study detailly about the winds because there is no data obtained from direct observations of the winds over Banjarmasin City. However, the data of the winds observed at the mouth of the Barito River may be used to study to get tendency of wind condition instead of city's.

(1) The prevailing wind in the year is north wind in the morning while south wind in the afternoon.
(2) A gust of over 10m/sec. in speed happens to blow in the rainy season or during rain, but the duration of the gust is short.
(3) The wind appearing most frequently through a year is the one whose speed is less than 3m/sec.

That is to say, as the feature of the tropical heavy rainfall forest zone, there strong winds generate very few and appears north wind in the morning while south wind in the afternoon.

Analizing these data with monthly level, the months having the strong tendency such as appearing north wind in the morning and south wind in the afternoon are October and November, and each one month before and after this period has a tendency following the above. (See Figure 10-2)

Owing to this condition of the winds and the reason that the Barito River runs southwards from north in the vicinity of Trisakti Pier of Banjarmasin Port, it is estimated that the exhausted smokes, etc. from the factories located around the side of the Barito River would rarely flow toward Banjarmasin City, but flow northward or southward almost along the Barito River and result to diffuse.

Accordingly, it may be evaluated as a proper planning to have planned to locate main industrial lands along the side of the Barito River.

On the other hand, it is prospected to locate industries along the side of the bypass expected to be constructed south of the city. It is necessary, however, to guide to locate in this area those industries such as so called the city type industries (the machine repair and manufacturing industry, and so on.) which do not generate smokes accompaning bad or stimulant smell, and to exclude strictly other type industries.

10-3. Oil Pollution and Water Pollution

The promotion of industries in order to advance the local development will inevitably require to obtain source of energy and this follows that a large amount of fuel such as oil will be dealt with in Banjarmasin Port. And handling of chemical substances such as chemicals and additives which are necessary for industrial activities will also increase therearound, and these chemicals, etc. might be of dangerous characters.

Just as ships should pay always attention so as not to pollut adjacent water area with oil, etc. whether on navigation or at anchor, in the port, its activities should be administrated and operated so as not to pollut water.

However, the pullution of the water qualities of ports and are used to be caused mainly by so called urban waste water generated from urban activities or sewerage due to daily human lives almost of which will flow into the ports and harbors, because in general ports and harbors may be integrated with urban areas.

Banjarmasin Port, being a river port, might be free from a generation of an extreme pollution because she is always flushed with the running water of the Barito River having a speed of 1.0m/sec and a high rate of flow.

Yet, in order to maintain the safty for future, it should be put into planning from now that the urban waste water of Banjarmasin City is disposed within the city so as not to flow it easily into the basin of the port.

The oil handling facilities of Banjarmasin Port is located presently at Kuwin Selatan Region upper Torisakti Pier. After several investigations, it is decided to let the said facilities expand for use at the present region for the future development of the port.

From the results of the investigations by Dr. Kitajima and his team from this August to September, the following have been made clear.

(1) Owing to the variations of the outer sea level, the water flow of the Barito River may be reversed for a certain period, the duration of which is shorter than that of her effux time.
(2) The current velocity of the down stream is far higher than that of the reversed stream.

Hence, the water of the Barito River effuses steadily to the outer sea with repeating down or reverse once or twice a day, and this might prevent a generation of some amount of oil pollution from inducing a serious disaster.

Nevertheless, if a large amount of oil should happen to loss away and if its timing should coincide with the high tide time, the oil would float over the water area at the front of Torisakti Pier for about 6 hours after then, so that not only pollution but a danger of fire would be predicted fully. Therefore, to make assurance the handling of oil, it is necessary to take the improvement of oilproof walls, and oil fence, etc.

Figure 10-4 arranges the current directions and thier velocities about the water surface observed at the line A-A located upper side of Torisakti Pier. From these the following can be read.

(1) At the time of the full ebb tide, the current velocity of the river water surface will become higher than 1 m/sec. and its direction will coincide with the direction of the line of maximum current of the river way.
(2) At the case of once tide a day, the current having East-South direction will glow

well being pushed by the current which has passed round the West side of the Island of Kembang.

(3) At the case of once tide a day, most currents including that of maximum velocity at the time of the ebb tide will take East-South direction.

(4) At the high tide time, the currents will reverse and take almost North-East direction.

From the aboves, generally the following are determined.

(1) Without concerning the number of tide alternations, there will appear always more or less the currents at the front of Torisakti Pier of Banjarmasin Port and the durations of the currents will be long.

(2) So, if the oil leak or overflow from the oil terminal, it might reach Torisakti Pier of Banjarmasin within a comparatively short time. Hence, it is required to complete oil-proof arrangements and disaster protection arrangements for establishing countermeasures for preventing disasters as well as oil pollution.

10-4. Cooling Water and Hot Water

The plywood industry, the wooden wares processing industry, and so on require a large amount of steam, while the necessary condition for the pulp industry is to obtain a large amount of clean water cheap.

Also thermal power plants, and so on need a large amount of water as the cooling water.

Accordingly, it becomes an important problem how to obtain a required amount of clean water and hold it always available, whereas problems will generate about the exhausted water in ordinary cases.

It may be easy of the industries located along the side of Barito River to obtain the required amount of industrial water from the abundant water of that river. However, since the water of the Barito River is dyed red-brown with dye substances and, the suspended sediment therein being small quantitatively, as the feature of the tropical zone, is rich with suspended vegetable cells and animal substances such as planktons, the water should be filtered prior to being utilized.

The large amount of water having been utilized as cooling water will exhausted into the river, but the temperature of the water of the said river might not rise because of its abundance, so that this might not cause any environment destruction.

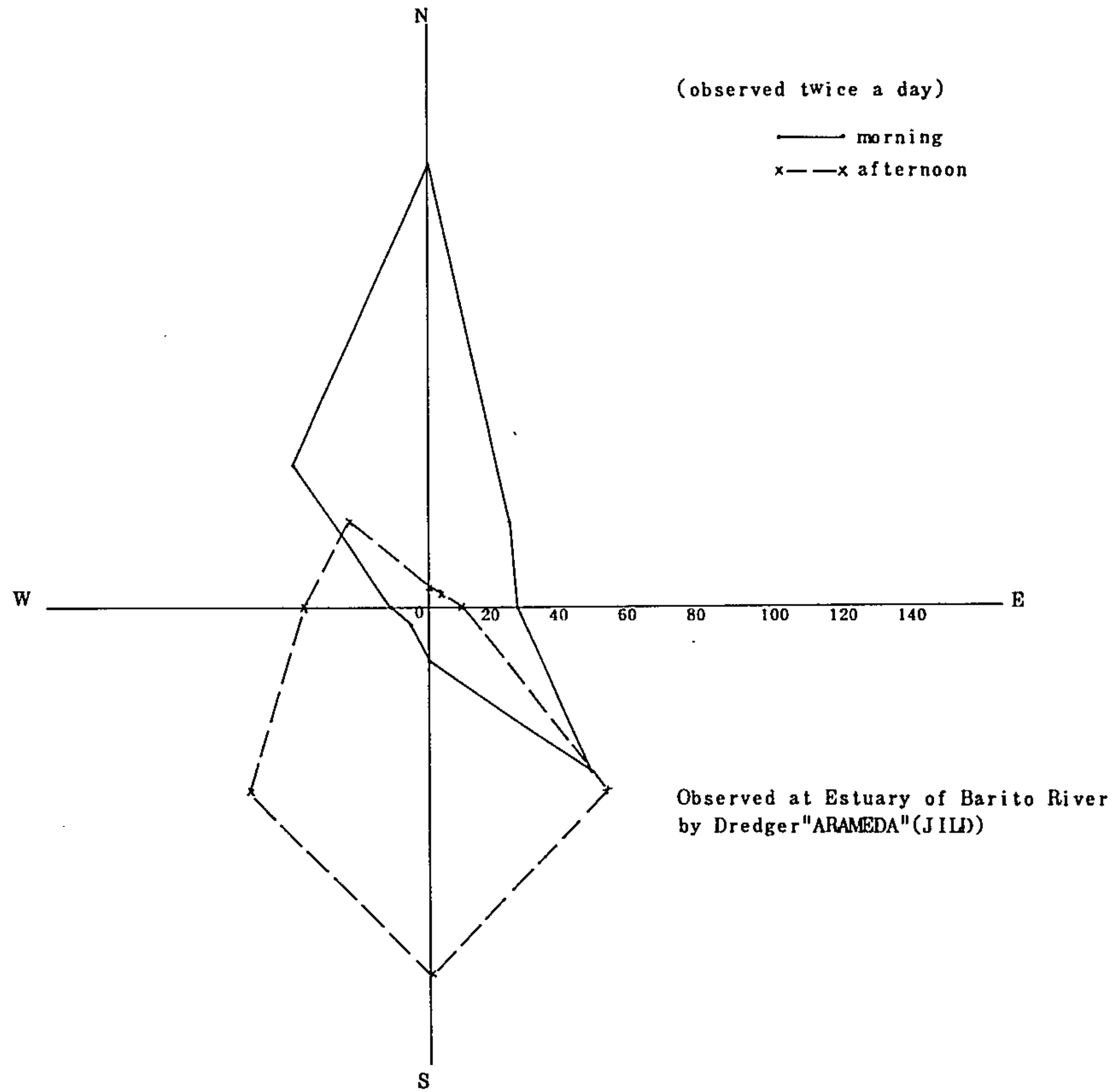


Fig. 10-1 Yearly Occurrence of Wind (1975 ~ 1976)

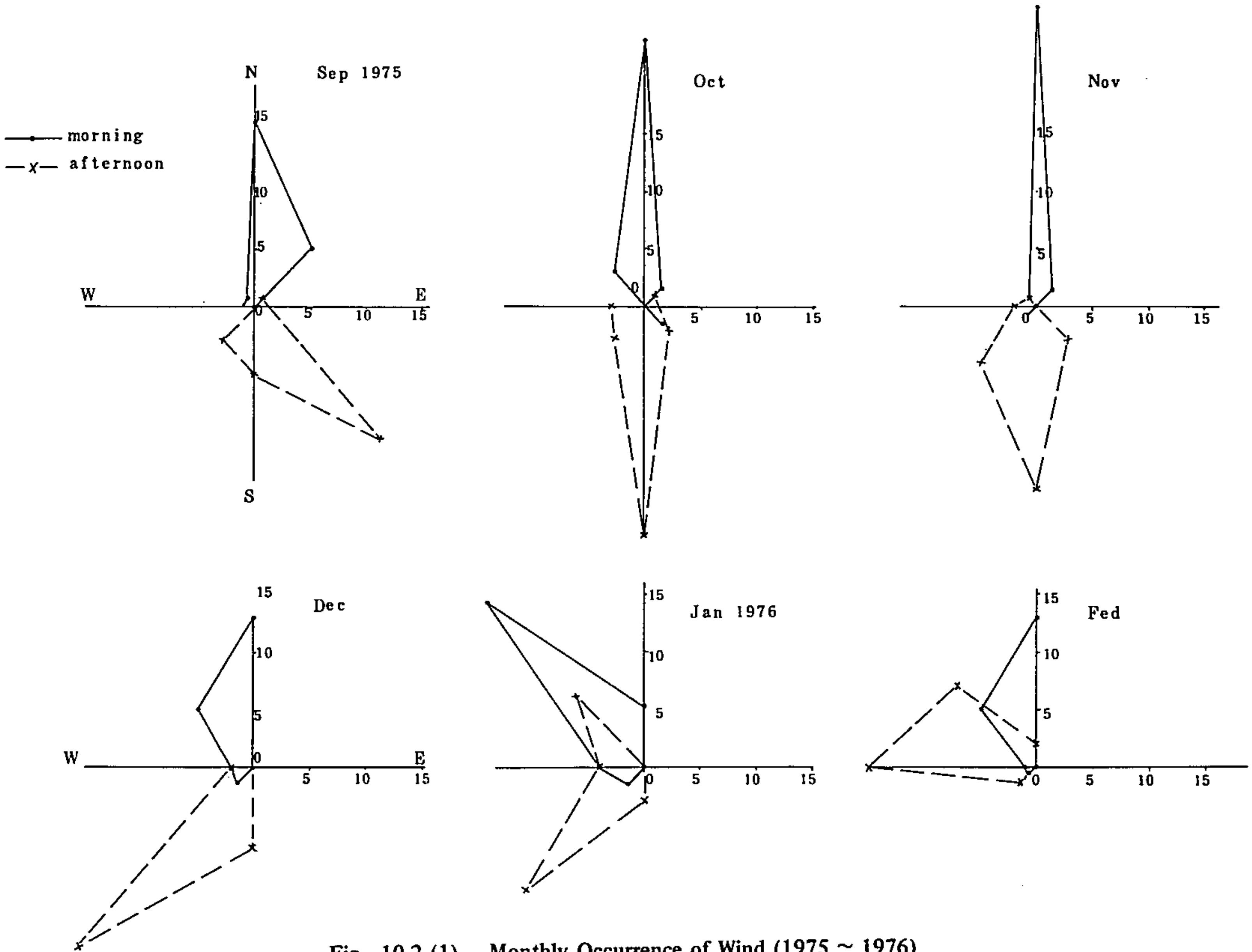


Fig. 10-2 (1) Monthly Occurrence of Wind (1975 ~ 1976)

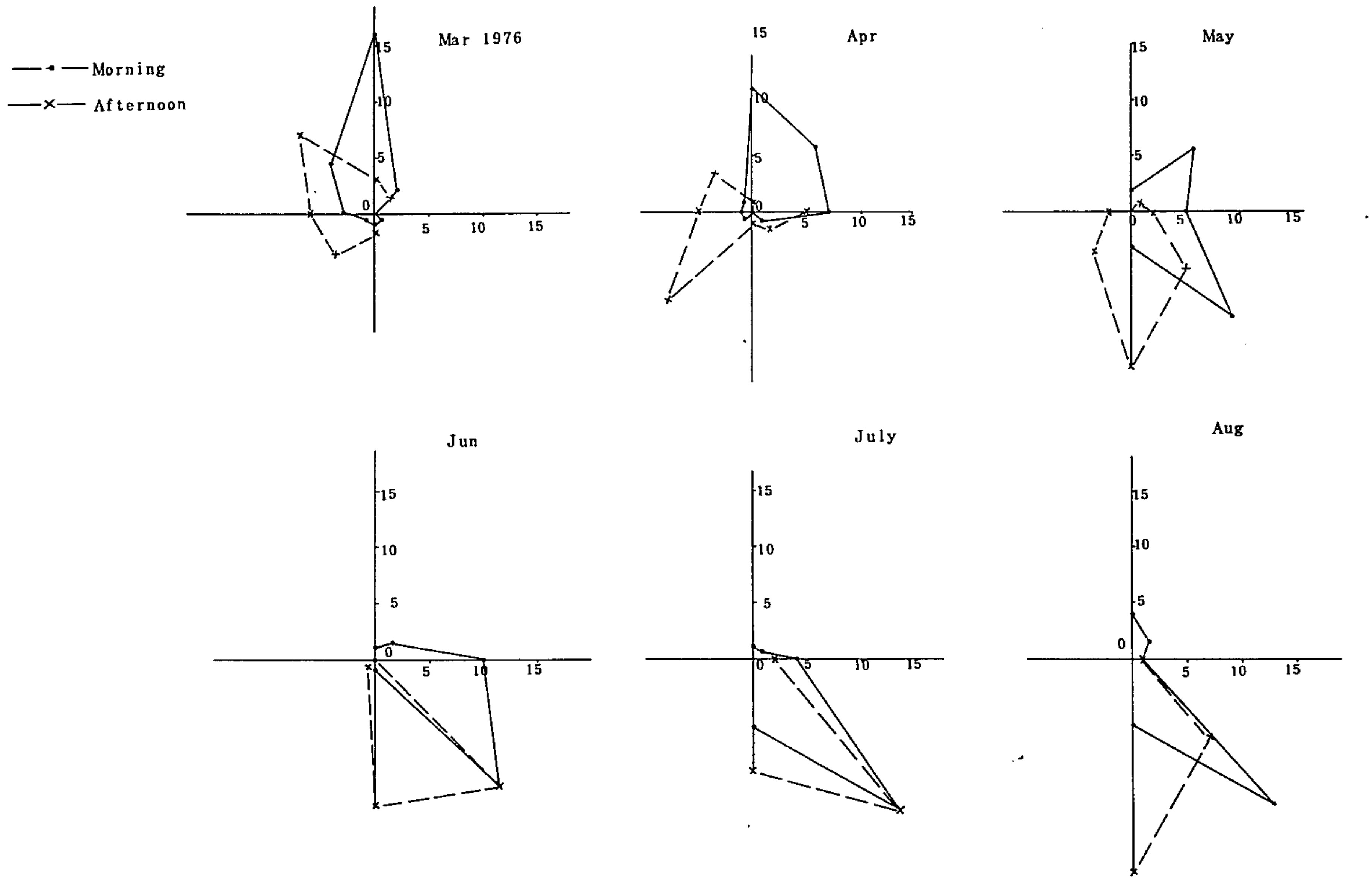


Fig. 10-2 (2) Monthly Occurrence of Wind (1975 ~ 1976)

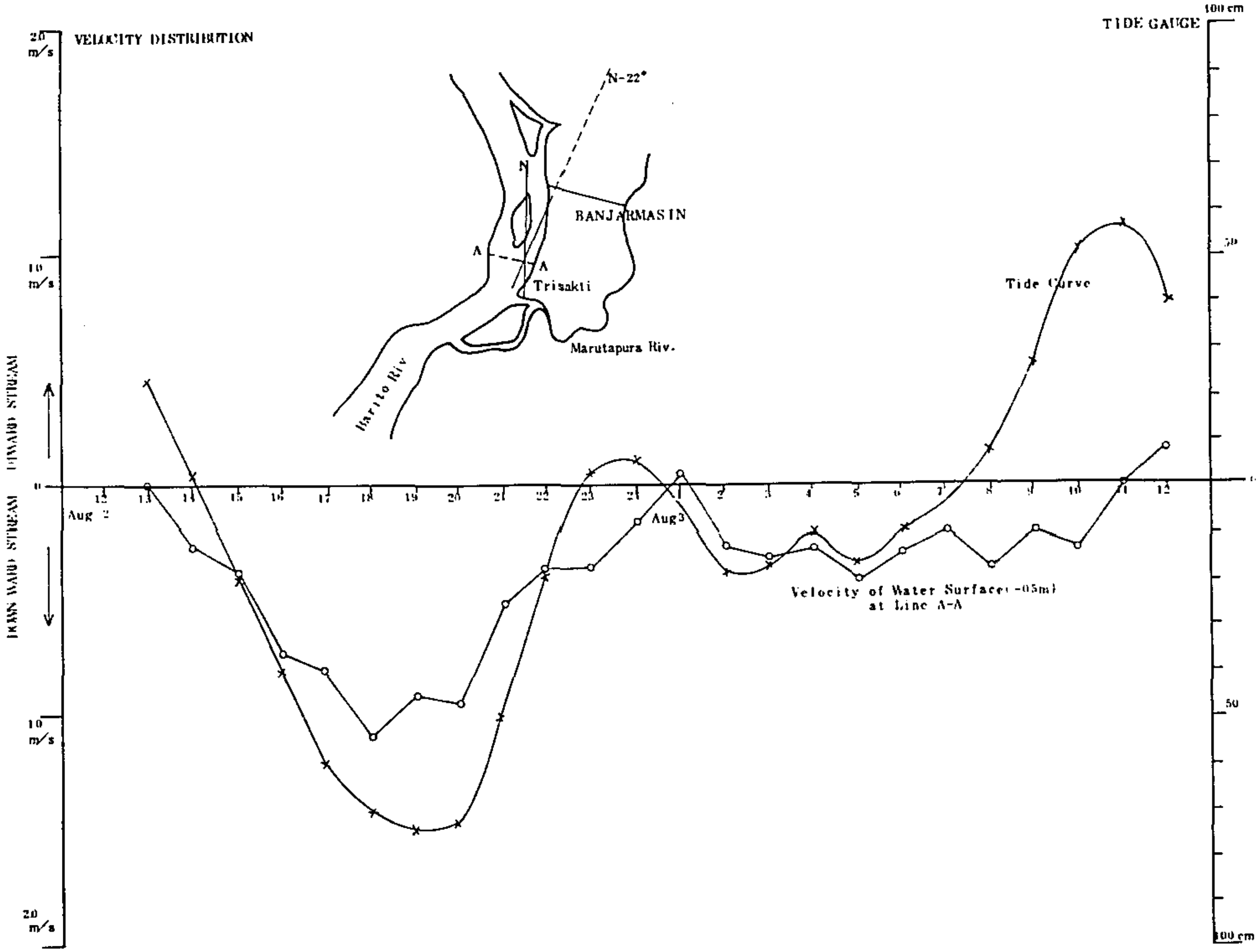


Fig. 10-3 (1) Current Velocity Distribution of Water Surface and Tide Curve at A-A Line

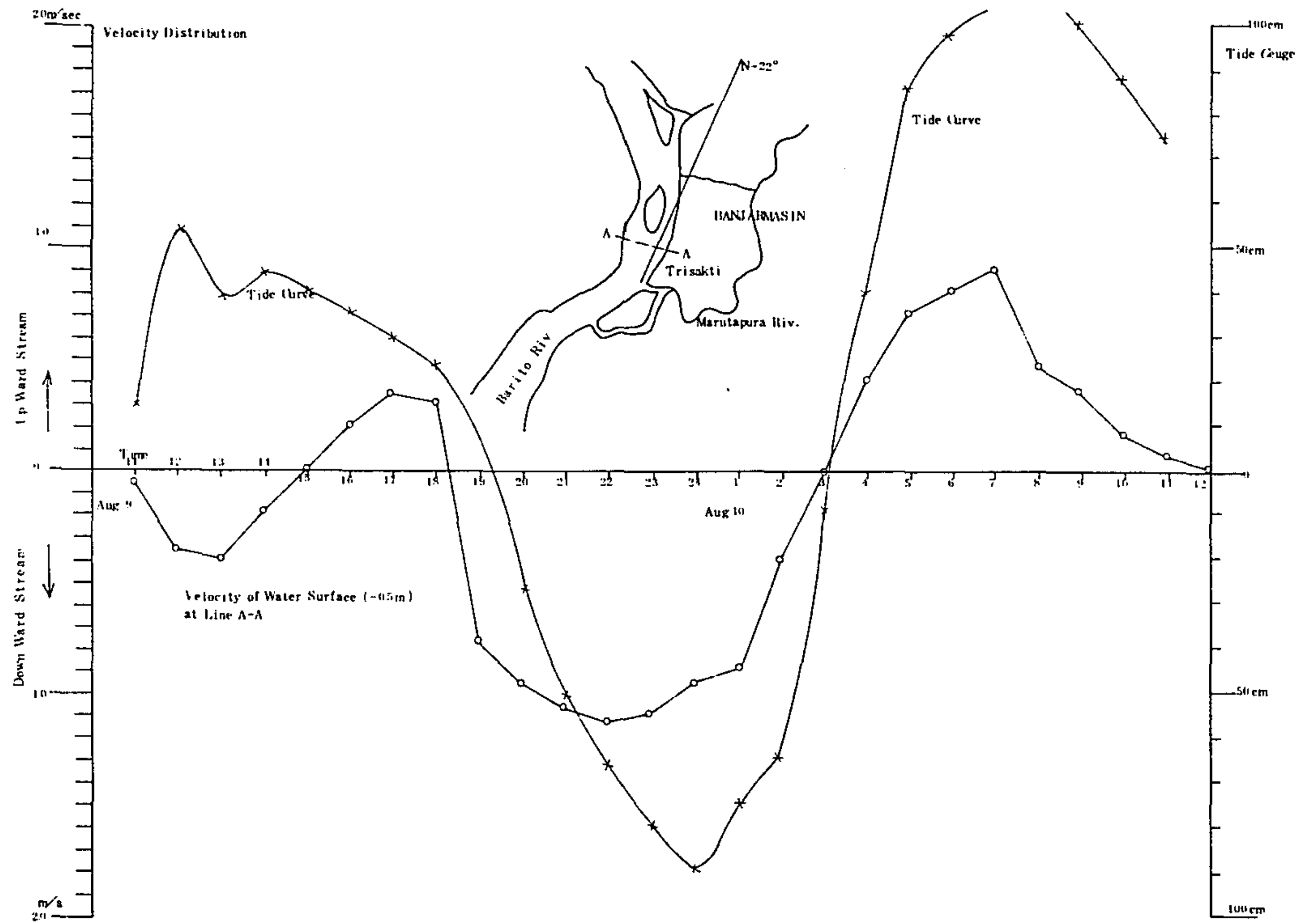


Fig. 10-3 (2) Current Velocity Distribution of Water Surface and Tide Curve at A-A Line

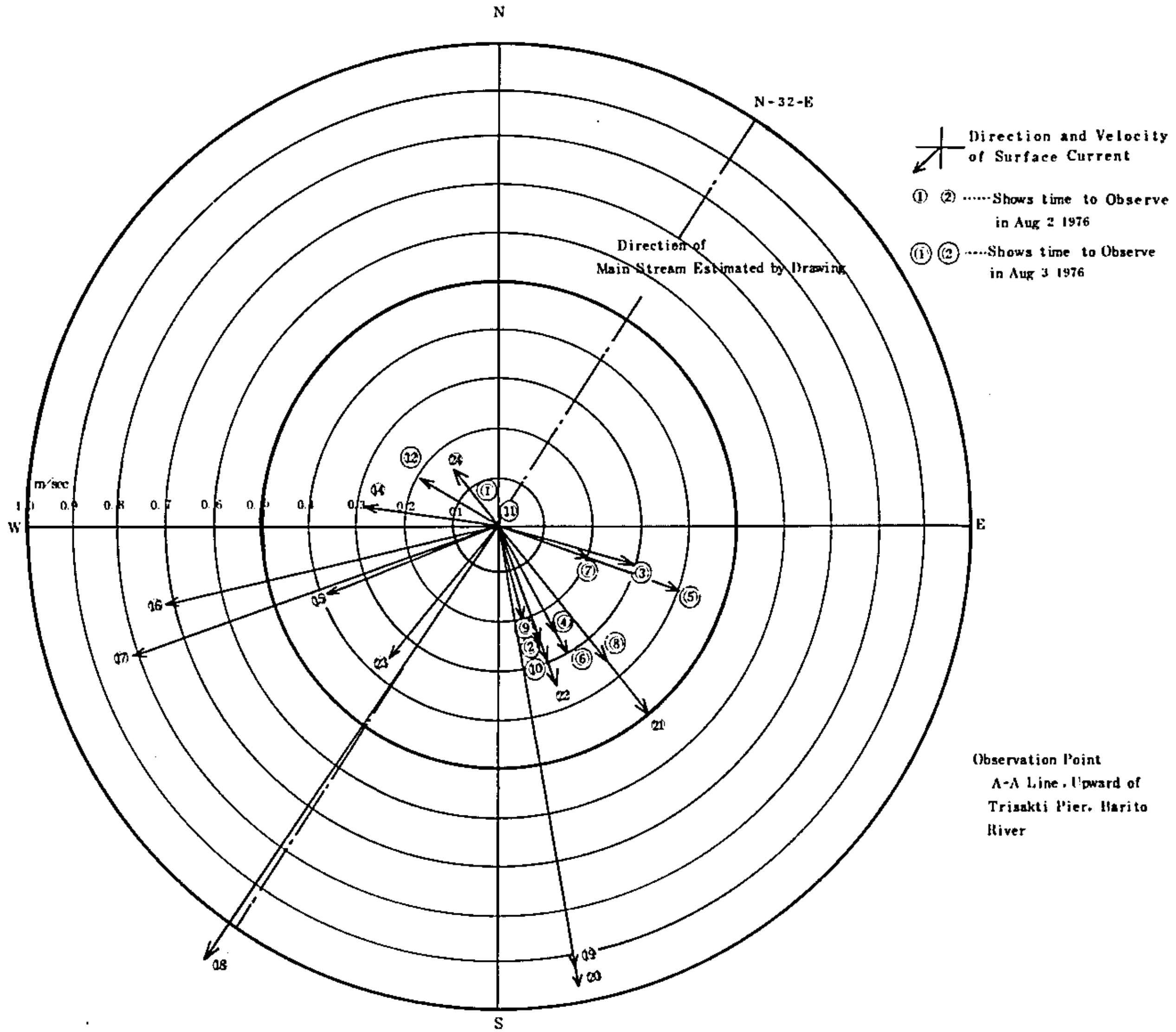


Fig. 10-4 (1) Current Direction and Veloctity of Water Surface at A-A Line

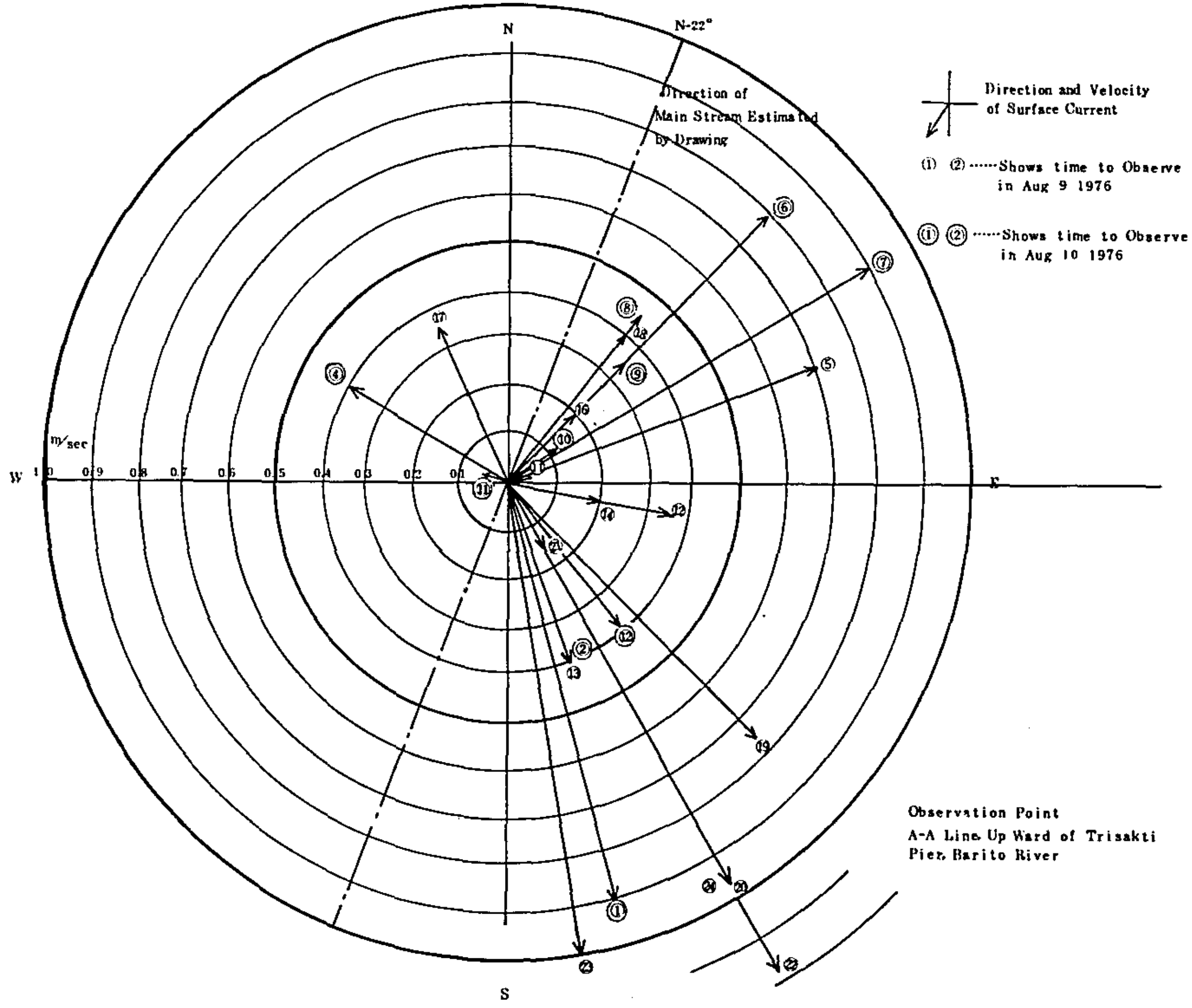


Fig. 10-4 (2) Current Direction and Velocity of Water Surface A-A Line

Appendix

Table A-1 Harvested Area, Production and Yield Rate of Paddy

		1972			1973			1974		
		Harvested Area (1,000 ha)	Production (1,000 t)	Yield Rate (t/ ha)	Harvested Area (1,000 ha)	Production (1,000 t)	Yield Rate (t/ha)	Harvested Area (1,000 ha)	Production (1,000 t)	Yield Rate (t /ha)
WET-LAND PADDY	Indonesia	6,602	23,402	3.5	7,064	25,902	3.7	7,376	27,871	3.8
	Jawa & Madra	4,006	15,056	3.8	4,235	16,471	3.9	4,438	17,859	4.0
	South Kalimantan	197	502	2.5	233	581	2.5	228	574	2.5
	Central Kalimantan	55	110	2.0	69	115	1.7	63	136	2.2
DRY-LAND PADDY	Indonesia	1,296	1,949	1.5	1,340	2,189	1.6	1,161	1,844	1.6
	Jawa & Madra	326	532	1.6	332	576	1.7	281	453	1.6
	South Kalimantan	18	24	1.3	26	37	1.4	17	26	1.5
	Central Kalimantan	40	55	1.4	49	68	1.4	48	66	1.4
Service Area	Wet				263	650	2.5			
	Dry				42	68	1.6			

Note: (1) Source: Central Bureau of Statistics - Statistik Indonesia.
(2) Values concerning to the Service Area are estimates (Refer Chapter 3).

Table A-2 G.D.P. of South & Central Kalimantan (Rp. Billions)

		G.D.P. (Nominal)	Agriculture, Forestry & Fishery		Manufacturing Industry		Growth Rate	
							Nominal	Real
Indonesia	1970	3,340	1,575	(47.2)	312	(9.3)	22.9	7.5
	1971	3,794	1,655	(43.6)	356	(9.4)	13.6	7.0
	1972	4,548	1,825	(40.1)	417	(9.2)	19.9	7.0
	1973	6,605	2,628	(39.8)	517	(7.8)	45.2	8.1
South Kalimantan	1970	47	23	(48.9)	2.1	(4.5)	35.4	22.6
	1971	55	25	(45.5)	2.5	(4.5)	15.2	9.2
	1972	61	28	(45.9)	2.7	(4.4)	11.4	4.3
	1973	89	39	(43.8)	2.9	(3.3)	46.2	11.1
Central Kalimantan	1970	41	30	(73.2)	0.5	(1.2)	32.0	17.7
	1971	44	32	(72.7)	0.6	(1.4)	7.4	7.6
	1972	46	33	(71.7)	0.7	(1.5)	5.4	2.7
Service Area	1973	124	67	(54.0)	5	(4.0)		

Note: (1) The parenthesized represents the composition in percentage.
(2) Source: Central Bureau of Statistics, BAPPEDA in South & Central Kalimantan.
(3) Values concerning to the Service Area are estimates (Refer to Chapter 3).

Table A-3 Woods Export in 1975 by Ports

	Logs		Processed Timber		Others		Total	
	Volume (1,000 m^3)	Value (1,000 U.S.$)	Volume (1,000 m^3)	Value (1,000 U.S.$)	Volume (1,000 m^3)	Value (1,000 U.S.$)	Volume (1,000 m^3)	Value (1,000 U.S.$)
Banjarmasin	790	28,247	20	1,458	60	770	870	30,475
Pegatan	167	6,401	4	312	2	111	173	6,824
Kotabaru	176	7,068					176	7,068
Batulicin	182	6,945					182	6,945
South Kalimantan	1,315	48,661	24	1,770	62	881	1,401	51,312
Pulang Pisau	554	19,239	15	962	5	186	574	20,387
Kuala Kapuas	5	186	9	582			14	768
Sampit	437	15,109	4	240			441	15,349
Kumai	17	611			1	17	18	628
Pangkalan Bun	11	364			20	674	31	1,038
Central Kalimantan	1,024	35,509	28	1,784	26	877	1,078	38,170

Note: (1) Value is at F.O.B price.
(2) Source: Central Bureau of Statistics - Ekspor.

Table A-4 Population of South & Central Kalimantan

	Area		Population		Density
	1,000 ha	%	1,000 persons	%	person/ha
Indonesia	190,457	100	118,368	100	0.62
Kalimantan	53,946	28.3	5,153	4.4	0.10
South Kalimantan	3,766	2.0	1,699	1.4	0.45
Central Kalimantan	15,260	8.0	702	0.6	0.05
Banijarmasin City	7	0.0	271	0.2	38.71
Service Area	11,100	5.8	2,008	1.7	0.18

Note: (1) Source: Central Bureau of Statistics - 1971 Population Census, Topographical Service.
(2) Values concerning to the Service Area are estimates (Refer to Chapter 3).

Table A-5 Labor Force by Industries

	Labor Force (1,000persons)	Percentage to Total Population (%)	Agriculture, Forestry & Fishery (1,000 persons)		Manufacturing Industry (1,000 persons)	
		%				
Indonesia	41,261	34.9	26,473	(64.2)	2,682	(6.5)
South Kalimantan	589	34.7	411	(69.8)	23	(3.9)
Central Kalimantan	209	29.8	167	(79.9)	5	(2.4)
Service Area	676	33.7	481	(71.2)	24	(3.6)

Note: (1) The parenthesized represents the percentage to the labor force.
(2) Source: Central Bureau of Statistics · 1971 Population Census.
(3) Values concerning to the Service Area are estimates
(Refer to Chapter 3).

Table A-6 Numbers of Transmigration by Province of Settlement

	1973			1974		
	Families	Persons	% of Target Realized	Families	Persons	% of Target Realized
			%			%
Indonesia	15,580	72,018	95	4,464	18,418	41
South Kalimantan	500	2,327	100	200	851	67
Central Kalimantan	150	751	150	100	427	50

Note: (1) Source: Central Bureau of Statistics-Directorate General of Transmigration.
(2) Percentage of Target Realized is the ratio of results to policy target.

Table A-7: Average Percentage Frequency of Occurrence of Wind Speed-Direction Groups at 5° South, 115° East Offshore Cape Selatan, Kalimantan, During January

Direction	Wind Speed Groups (mph)									
	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 40	40 Plus	Total
N	1.6	1.5	0.4	0.3	0.2	0.0	0.0	0.0	0.0	4.0
NE	1.3	1.0	0.3	0.2	0.2	0.0	0.0	0.0	0.0	3.0
E	1.3	1.0	0.3	0.2	0.2	0.0	0.0	0.0	0.0	3.0
SE	1.9	1.9	0.5	0.4	0.3	0.0	0.0	0.0	0.0	5.0
S	1.5	1.3	1.2	1.0	0.8	0.1	0.1	0.0	0.0	6.0
SW	1.6	1.3	2.3	1.9	1.4	0.3	0.2	0.0	0.0	9.0
W	9.0	7.7	8.5	7.3	5.6	0.9	0.8	0.2	0.0	40.0
NW	6.8	5.3	6.5	5.7	4.3	0.7	0.6	0.1	0.0	30.0
Total	25.0	21.0	20.0	17.0	13.0	2.0	1.7	0.3	0.0	100.0

Table A-8: Average Percentage Frequency of Occurrence of Wind Speed-Direction Groups at 5° South, 115° East Offshore Cape Selatan, Kalimantan, During April

Direction	Wind Speed Groups (mph)									
	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 40	40 Plus	Total
N	1.4	2.6	0.6	0.3	0.1	0.0	0.0	0.0	0.0	5.0
NE	1.4	3.7	2.2	1.2	0.4	0.1	0.0	0.0	0.0	9.0
E	2.7	10.6	8.4	4.8	2.1	0.5	0.5	0.2	0.2	30.0
SE	2.7	8.6	5.0	2.8	1.1	0.3	0.3	0.1	0.1	21.0
S	1.6	4.5	2.6	1.5	0.6	0.1	0.1	0.0	0.0	11.0
SW	1.4	2.6	0.6	0.3	0.1	0.0	0.0	0.0	0.0	5.0
W	1.4	4.0	2.2	1.2	0.2	0.0	0.0	0.0	0.0	9.0
NW	1.4	4.4	2.4	1.4	0.4	0.0	0.0	0.0	0.0	10.0
Total	14.0	41.0	24.0	13.5	5.0	1.0	0.9	0.3	0.3	100.0

Table A-9: Average Percentage Frequency of Occurrence of Wind speed-Direction Groups at 5° South, 115° East Offshore Cape Selatan, Kalimantan, During August

Direction	Wind Speed Groups (mph)									
	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 40	40 Plus	Total
N	0.4	0.7	0.6	0.2	0.1	0.0	0.0	0.0	0.0	2.0
NE	0.7	1.3	1.7	1.9	0.9	0.3	0.2	0.0	0.0	7.0
E	3.1	6.0	8.1	9.5	5.1	1.3	0.9	0.0	0.0	34.0
SE	3.7	6.4	9.0	10.5	5.7	1.5	1.1	0.1	0.0	38.0
S	1.2	2.2	2.9	3.2	1.8	0.4	0.3	0.0	0.0	12.0
SW	0.6	1.1	1.4	1.6	0.9	0.2	0.2	0.0	0.0	6.0
W	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	1.0
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	10.0	18.0	24.0	27.0	14.5	3.7	2.7	0.1	0.0	100.0

Table A-10: Average Percentage Frequency of Occurrence of Wind speed-Direction Groups at 5° South, 115° East Offshore Cape Selatan, Kalimantan, During October

Direction	Wind Speed Groups (mph)									
	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 40	40 Plus	Total
N	3.2	2.6	2.1	1.1	0.0	0.0	0.0	0.0	0.0	9.0
NE	3.5	2.9	2.3	1.3	0.0	0.0	0.0	0.0	0.0	10.0
E	4.6	3.7	3.0	1.6	0.1	0.0	0.0	0.0	0.0	13.0
SE	6.6	5.5	4.3	2.5	0.1	0.0	0.0	0.0	0.0	19.0
S	4.6	3.7	3.0	1.6	0.1	0.0	0.0	0.0	0.0	13.0
SW	4.5	3.8	3.0	1.6	0.1	0.0	0.0	0.0	0.0	13.0
W	4.2	3.5	2.8	1.5	0.0	0.0	0.0	0.0	0.0	12.0
NW	3.8	3.3	2.5	1.4	0.0	0.0	0.0	0.0	0.0	11.0
Total	35.0	29.0	23.0	12.6	0.4	0.0	0.0	0.0	0.0	100.0

Table A-11: Average Percentage Frequency of Occurrence of Wave height-Direction Groups at 5° South, 115° East Offshore Cape Selatan, Kalimantan, During January

Direction	Significant Wave Height Groups (Ft.)							
	0 - 1.9	2 - 3.9	4 - 5.9	6 - 7.9	8 - 9.9	10 - 15	15 Plus	Total
N	3.1	0.4	0.3	0.2	0.0	0.0	0.0	4.0
NE	2.3	0.3	0.2	0.2	0.0	0.0	0.0	3.0
E	2.3	0.3	0.2	0.2	0.0	0.0	0.0	3.0
SE	3.8	0.5	0.4	0.3	0.0	0.0	0.5	5.0
S	2.8	1.2	1.0	0.8	0.1	0.0	0.0	6.0
SW	2.9	2.3	1.9	1.4	0.2	0.0	0.0	9.0
W	16.7	8.5	7.3	5.6	0.8	0.2	0.0	40.0
NW	12.1	6.5	5.7	4.3	0.6	0.1	0.0	30.0
Total	46.0	20.0	17.0	13.0	1.7	0.3	0.0	100.0

Table A-12: Average Percentage Frequency of Occurrence of Wave height-Direction Groups at 5° South, 115° East Offshore Cape Selatan, Kalimantan, During April

Direction	Significant Wave Height Groups (Ft.)							
	0 - 1.9	2 - 3.9	4 - 5.9	6 - 7.9	8 - 9.9	10 - 15	15 Plus	Total
N	4.0	0.6	0.3	0.1	0.0	0.0	0.0	5.0
NE	5.1	2.2	1.2	0.4	0.1	0.0	0.0	9.0
E	13.3	8.4	4.8	2.1	0.5	0.7	0.2	30.0
SE	11.3	5.0	2.8	1.1	0.3	0.4	0.1	21.0
S	6.1	2.6	1.5	0.6	0.1	0.1	0.0	11.0
SW	4.0	0.6	0.3	0.1	0.0	0.0	0.0	5.0
W	5.4	2.2	1.2	0.2	0.0	0.0	0.0	9.0
NW	5.8	2.4	1.4	0.4	0.0	0.0	0.0	10.0
Total	55.0	24.0	13.5	5.0	1.0	1.2	0.3	100.0

Table A-13: Average Percentage Frequency of Occurrence of Wave height-Direction Groups at 5° South, 115° East Offshore Cape Selatan, Kalimantan, During August

Direction	Significant Wave Height Groups (Ft.)							
	0 - 1.9	2 - 3.9	4 - 5.9	6 - 7.9	8 - 9.9	10 - 15	15 Plus	Total
N	1.1	0.6	0.2	0.1	0.0	0.0	0.0	2.0
NE	2.0	1.7	1.9	0.9	0.3	0.2	0.0	7.0
E	9.1	8.1	9.5	5.1	1.3	0.9	0.0	34.0
SE	10.1	9.0	10.5	5.7	1.5	1.2	0.0	33.0
S	3.4	2.9	3.2	1.8	0.4	0.3	0.0	12.0
SW	1.7	1.4	1.6	0.9	0.2	0.2	0.0	6.0
W	0.6	0.3	0.1	0.0	0.0	0.0	0.0	1.0
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	28.0	24.0	27.0	14.5	3.7	2.8	0.0	100.0

Table A-14: Average Percentage Frequency of Occurrence of Wave height-Direction Groups at 5° South, 115° East Offshore Cape Selatan, Kalimantan, During October

Direction	Significant Wave Height Groups (Ft.)							
	0 - 1.9	2 - 3.9	4 - 5.9	6 - 7.9	8 - 9.9	10 - 15	15 Plus	Total
N	5.8	2.1	1.1	0.0	0.0	0.0	0.0	9.0
NE	6.4	2.3	1.3	0.0	0.0	0.0	0.0	10.0
E	8.3	3.0	1.6	0.1	0.0	0.0	0.0	13.0
SE	12.1	4.3	2.5	0.1	0.0	0.0	0.0	19.0
S	8.3	3.0	1.6	0.1	0.0	0.0	0.0	13.0
SW	8.3	3.0	1.6	0.1	0.0	0.0	0.0	12.0
W	7.7	2.8	1.5	0.0	0.0	0.0	0.0	12.0
NW	7.1	2.5	1.4	0.0	0 0	0.0	0.0	11.0
Total	64.0	23.0	12.6	0.4	0.0	0.0	0.0	100.0

Table A-15: Visual Observation of Wave Height
Aug. 1975 to Aug. 1976

Month	Maximum Wave Height (m)															
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
75 A				2	1	7	1		1		1					7
S		4	9	16	8	2	3	3	1		3		1			
O		12	12	15	9	7	4	3								
N	1	15	16	16	3	6	2	1	2							
D	1	11	8	11	9	8	1	1	5	1			4			2
76 J	1	3	10	13	7	17	6	1	1		1					1
F		16	14	18	2	7	1									
M	1	8	14	17	5	10	2		2		3					
A		7	14	26	6	3	3				1					
M		4	1	14	6	6	7	5	10		8					1
J				7	1	10	6	10	9	3	14					
J			1	1	1	13	9	12	9	2	5		4			5
A	1	9	3	15	20	12	2									

Frequency of occurrence (observed twice a day)

Table A-16: Directional Distribution of Wave Height Above 0.5 m

Month	W	NW	N	NE	E	SE	S	SW	Total
75 A			7 1			 7			7 8
S		1	1			 16	 1	 1	2 18
O	2 1		1	 1		 7		 1	3 10
N	 2					 3	 1	 4	0 10
D	2 1	2						 13	4 14
76 J	2 14	4						1 10	7 24
F	 4	2 1						 1	2 6
M	1 3	3	 1				1 2	 6	5 12
A					2 4	 1		 2	2 7
M				2	3 3	11 7	 10	 1	16 21
J				1	6 1	14 15	2 12	 1	23 29
J			1	 1	 2	24 20	3 8		28 31
A						3 2	 6	 3	3 11
Total	7 25	12 1	10 2	3 2	11 10	52 78	6 40	1 43	102 201

Upper column: in the morning

Lower column: in the afternoon

Table A-17: Directional Distribution of Wave Height Above 1.0 m

Month	W	NW	N	NE	E	SE	S	SW	Total
75 A						 8			0 8
S						 3			0 3
O									0 0
N									0 0
D	 1	1 						 4	1 5
76 J		1 						 1	1 1
F									0 0
M	 1						 1	 2	0 4
A									0 0
M				1 		2 3	 3		3 6
J						7 7	2 2		9 9
J					 1	5 6	1 		6 7
A									0 0
Total	0 2	2 0	0 0	1 0	0 1	14 27	3 6	0 7	20 43

Upper column: in the morning
Lower column: in the afternoon

Table A-18: Occurrence of Wind (Jild Alameda II)

Month \ Direction	N	NE	E	SE	S	SW	W	NW	Total
1975 Sep.	17	7 1		 16	 6	 4	1	1	26 27
Oct.	23	2 1		2 3	 20	 4	 3	4	31 31
Nov.	26	2		 4	 16	1 7	 2	1 1	30 30
Dec.	13				 7	2 22	2 2	14	31 31
1976 Jan.	5				 3	2 15	4 4	20 9	31 31
Feb.	13 2					1 2	1 15	14 10	29 29
Mar.	16 3	3 2		1	1 2	1 8	3 6	6 10	31 31
Apr.	11 1	8	7 5	1 2	 1	1 11	1 5	1 5	30 30
May	2	8 1	5 2	13 7	3 14	 5	 2		31 31
Jun.	1	2	10	16 16	1 13	 1			30 30
Jul.	1	1	4 2	19 19	6 10				31 31
Aug.	4	2	1 1	18 10	6 19				31 30
TOTAL	132 6	35 5	27 10	70 77	17 111	8 79	12 39	61 35	362 362

Upper column: in the morning
Lower column: in the afternoon

Table A-19: Analysis of Siltation

Equation	Object	Boundary Condition	Additional Condition	Remarks
Kinetic	River	Water discharge, water level	Internal friction between salt and fresh water	
	Tide	Tidal level, tidal current	Bottom friction Friction on the slopes of channel	Refraction, shoaling of shallow water wave
Energy	Wave	Height, length and period of incident wave	Energy loss on the slopes of channel	Breaking and deformation of wave
Momentum	Wave	Mass transport of incident wave	Energy loss in surf zone	Mass transport of shallow water wave
		Water discharge	Breaking wave caused by current	Water level and current in surf zone
		Tidal current	Interference between wave and current	
Diffusion	Suspended material	Material supplied by river and sea	Floatation, mixing and diffusion caused by tide, wave and salt wedge	
Continuity	River, tide, wave	Water discharge, tidal current and level		
		Mass transport of wave	Interference between wave and current	Spatial distribution of current
Suspended material	River and sea bottom change	Spatial distribution of suspended material	Wave, Current, Time lapse, Thickness of silted soil, Water content Relationship between organic material and void (gas content) Effect of navigation	

Table A-20: Harmonic Constants of Tide

	M_2	S_2	N_2	K_2	K_1	O_1	P_1	M_4	MS_4
Amplitude (cm)	34	5	9	5	64	31	20	–	–
Lag of tide (°)	209	279	247	257	20	79	27	–	–

Table A-21: Monthly Change of Mean Low Water Level

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
Height (cm)	+8	+9	+9	+7	0	-6	-11	-12	-7	-1	+2	+4

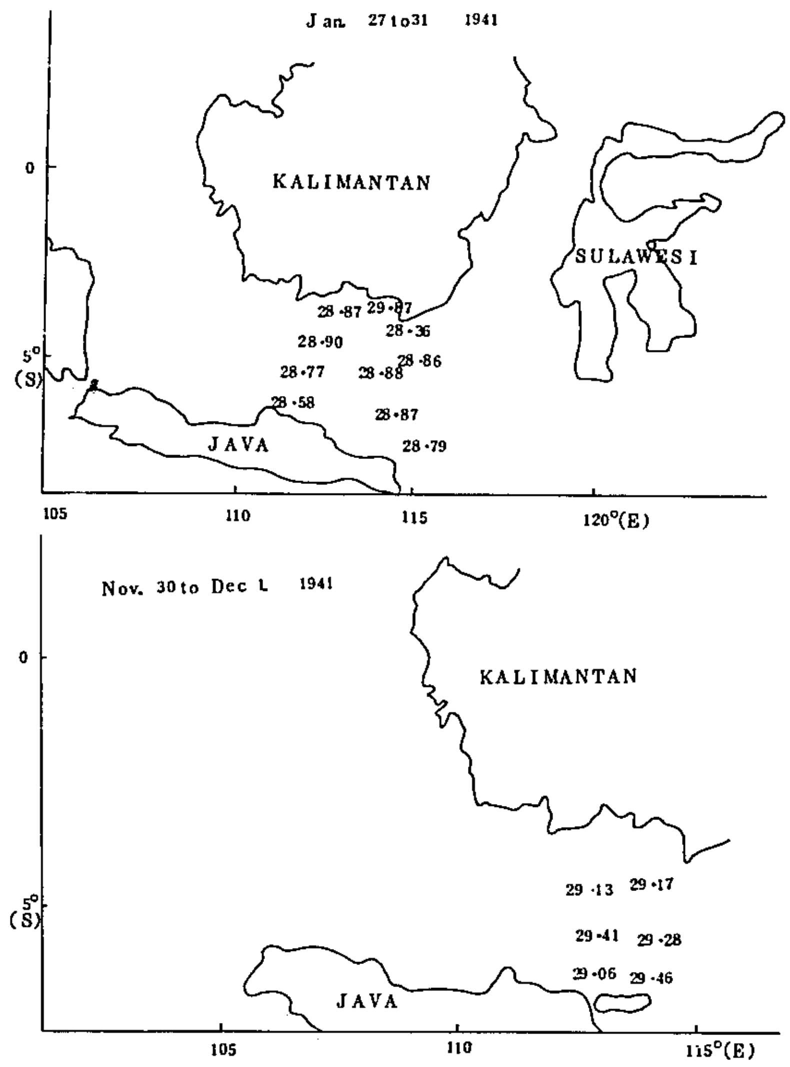


Fig. A-1 Surface temperature (°C)

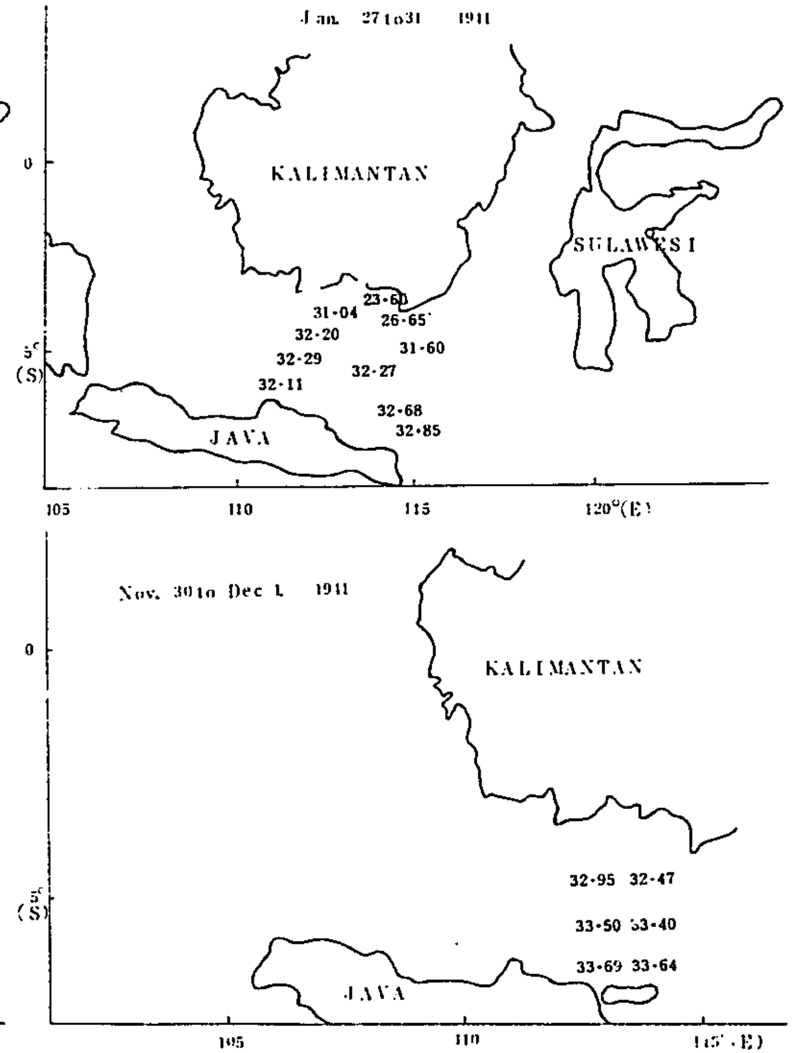


Fig. A-2 Salinity of Surface Water (°/oo)

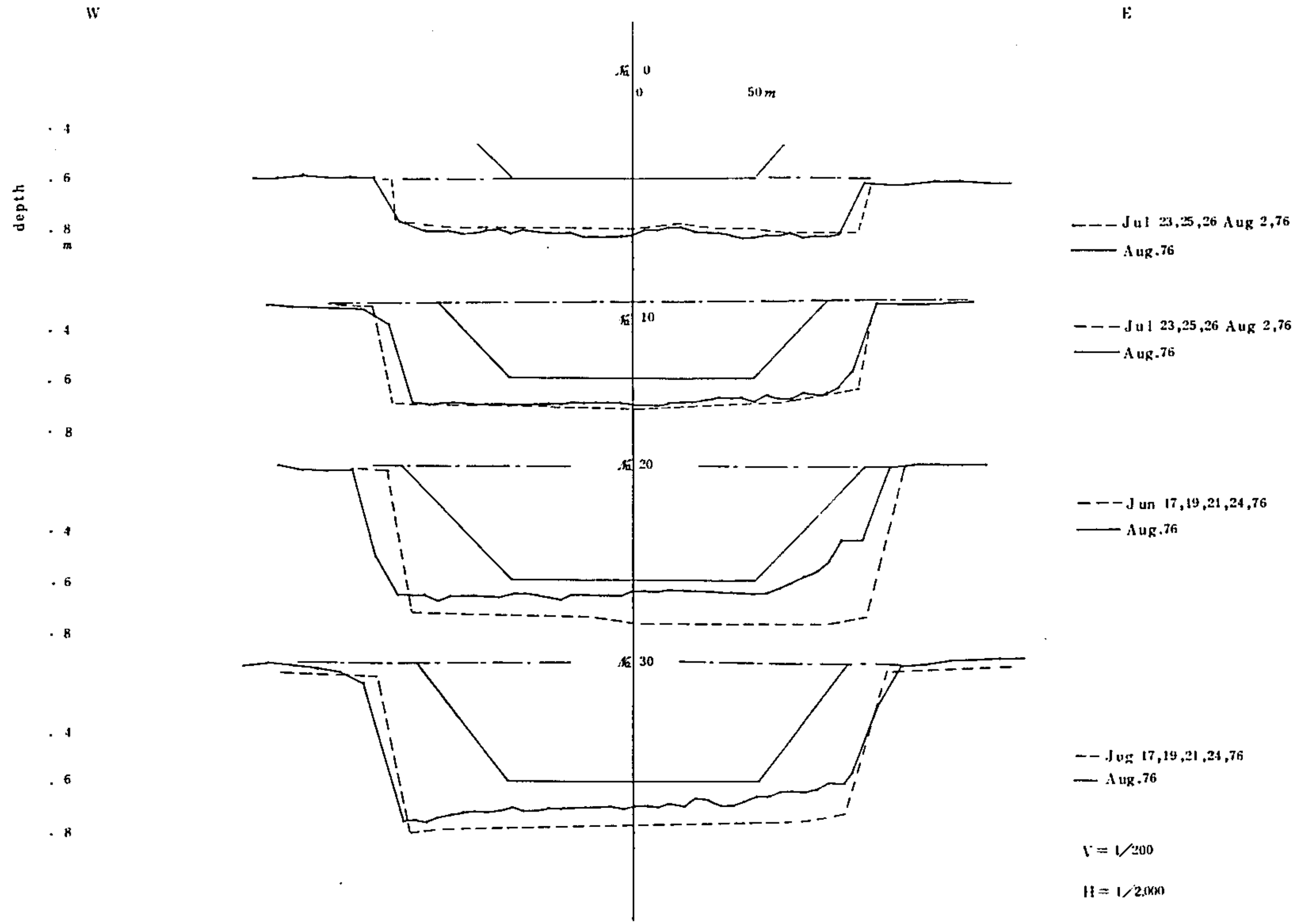


Fig. A-3 Cross Section of Dredged Channel

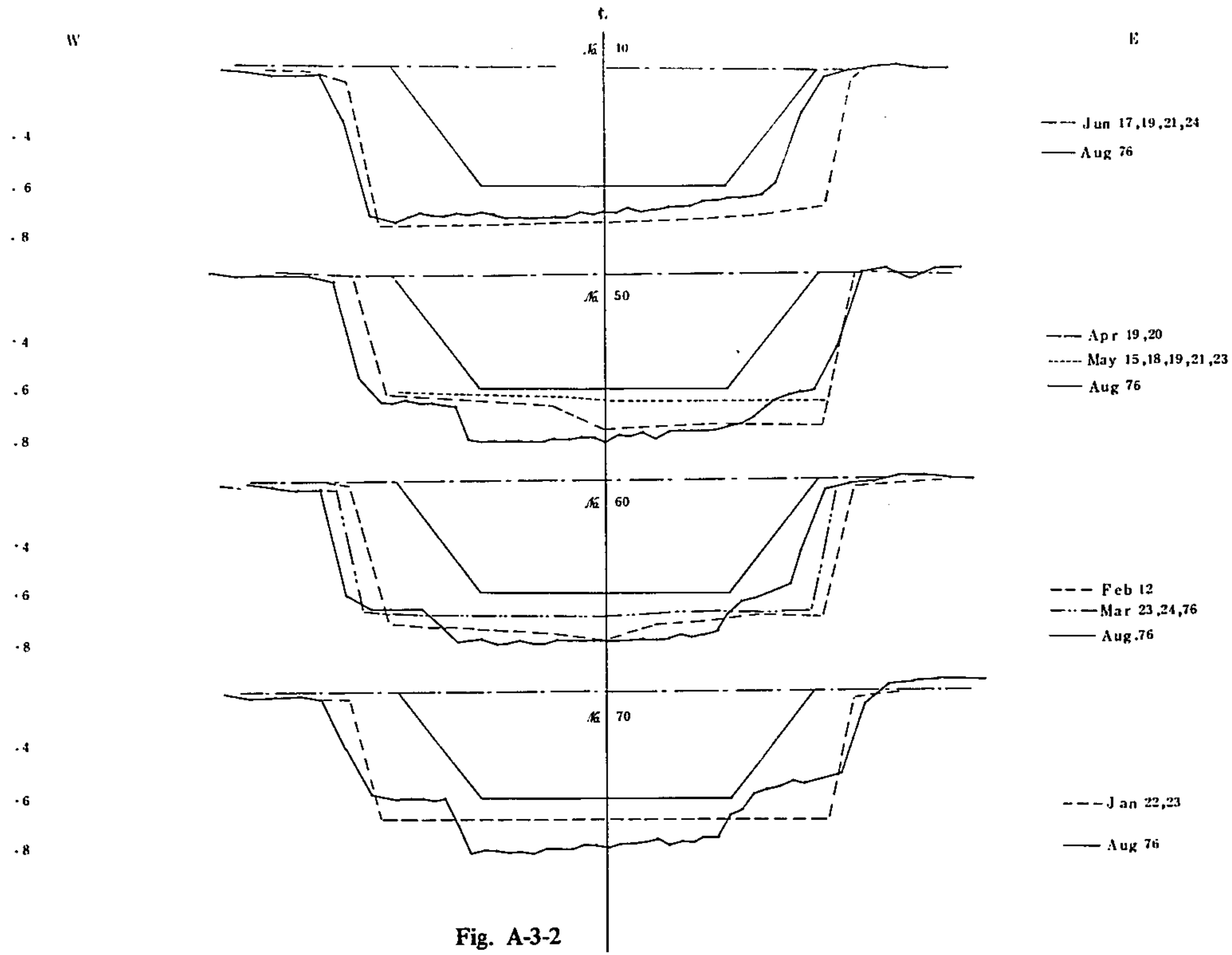

W
E
℄
№ 10
№ 50
№ 60
№ 70
.4
.6
.8
Jun 17,19,21,24
Aug 76
Apr 19,20
May 15,18,19,21,23
Aug 76
Feb 12
Mar 23,24,76
Aug.76
Jan 22,23
Aug 76

Fig. A-3-2

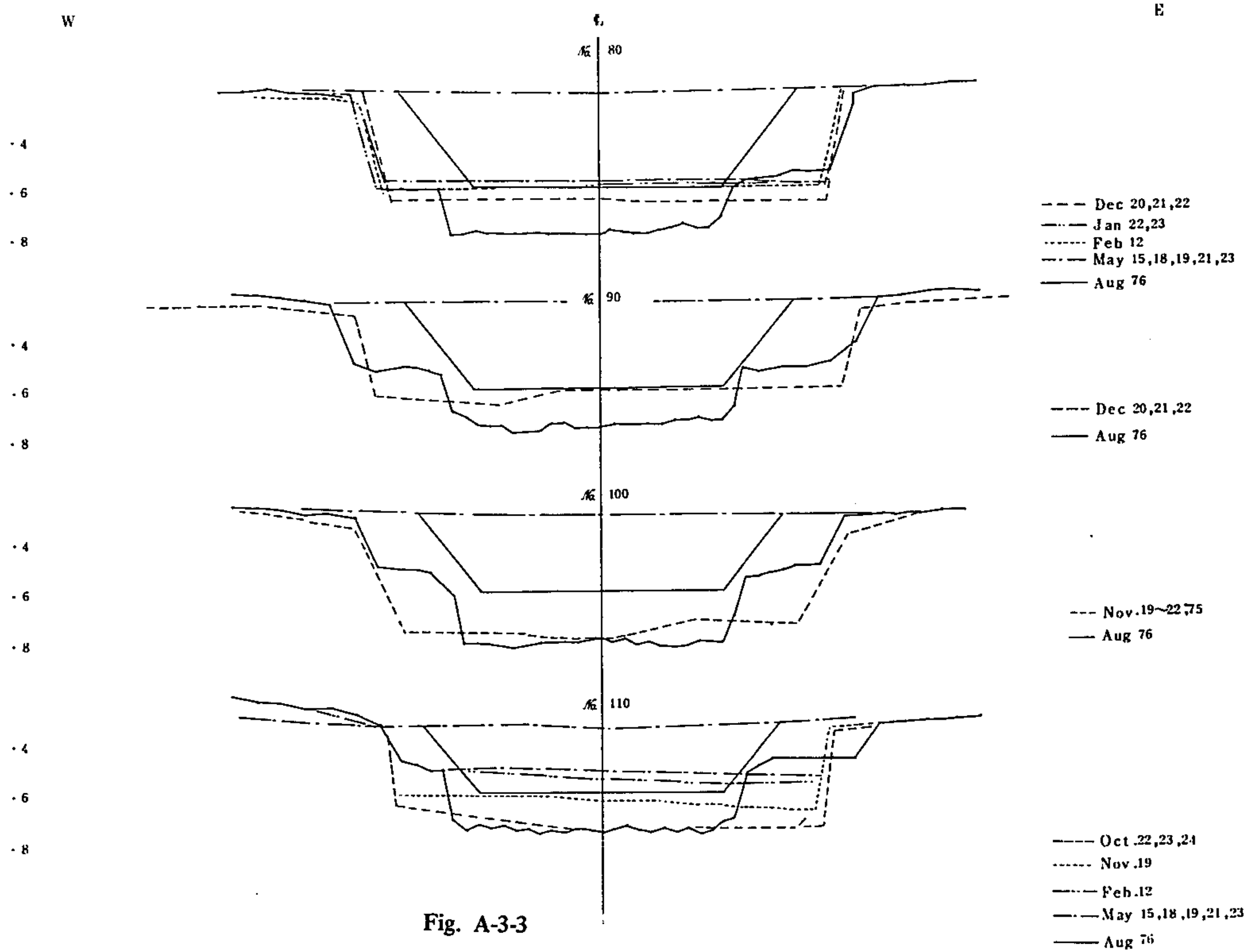
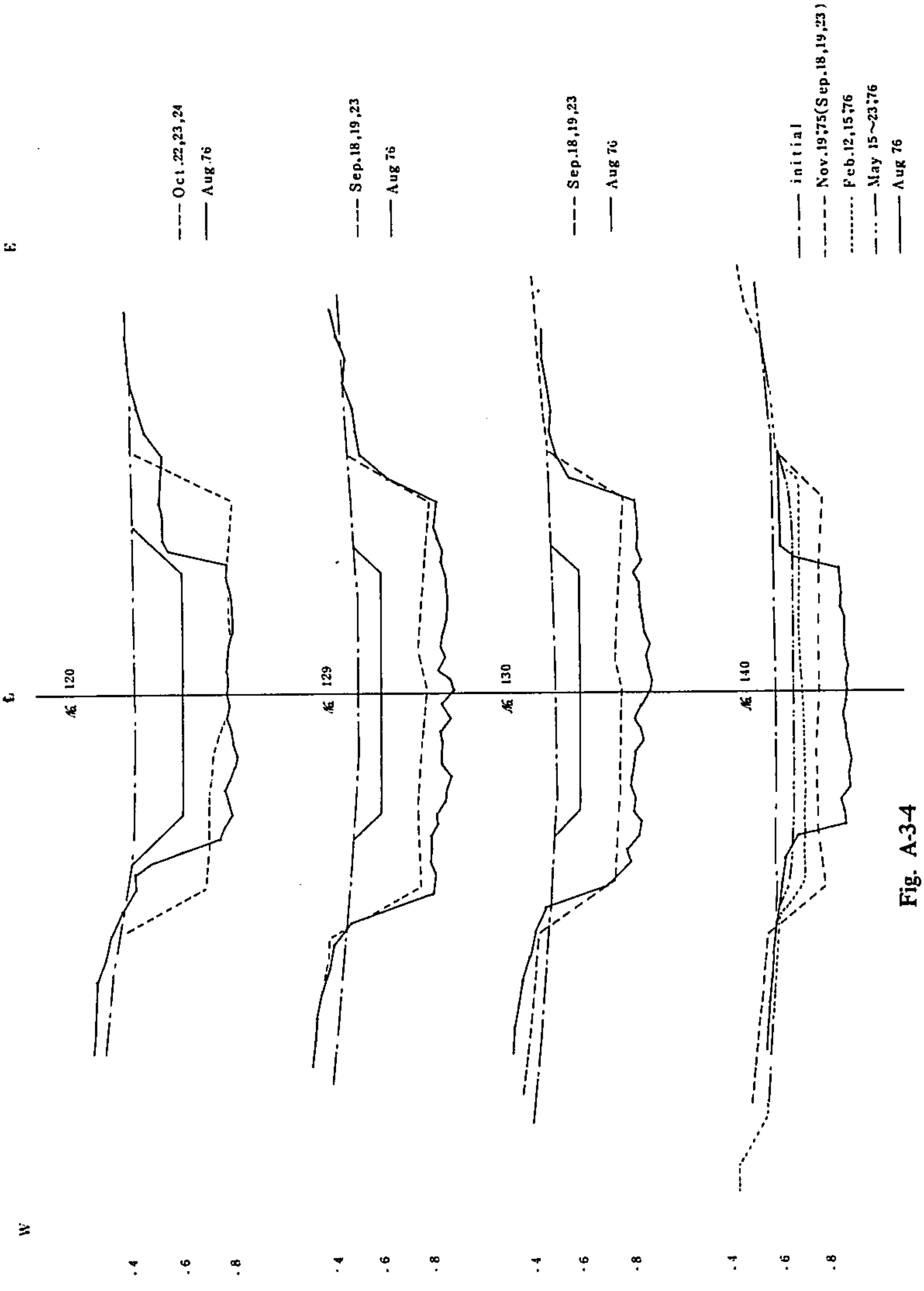
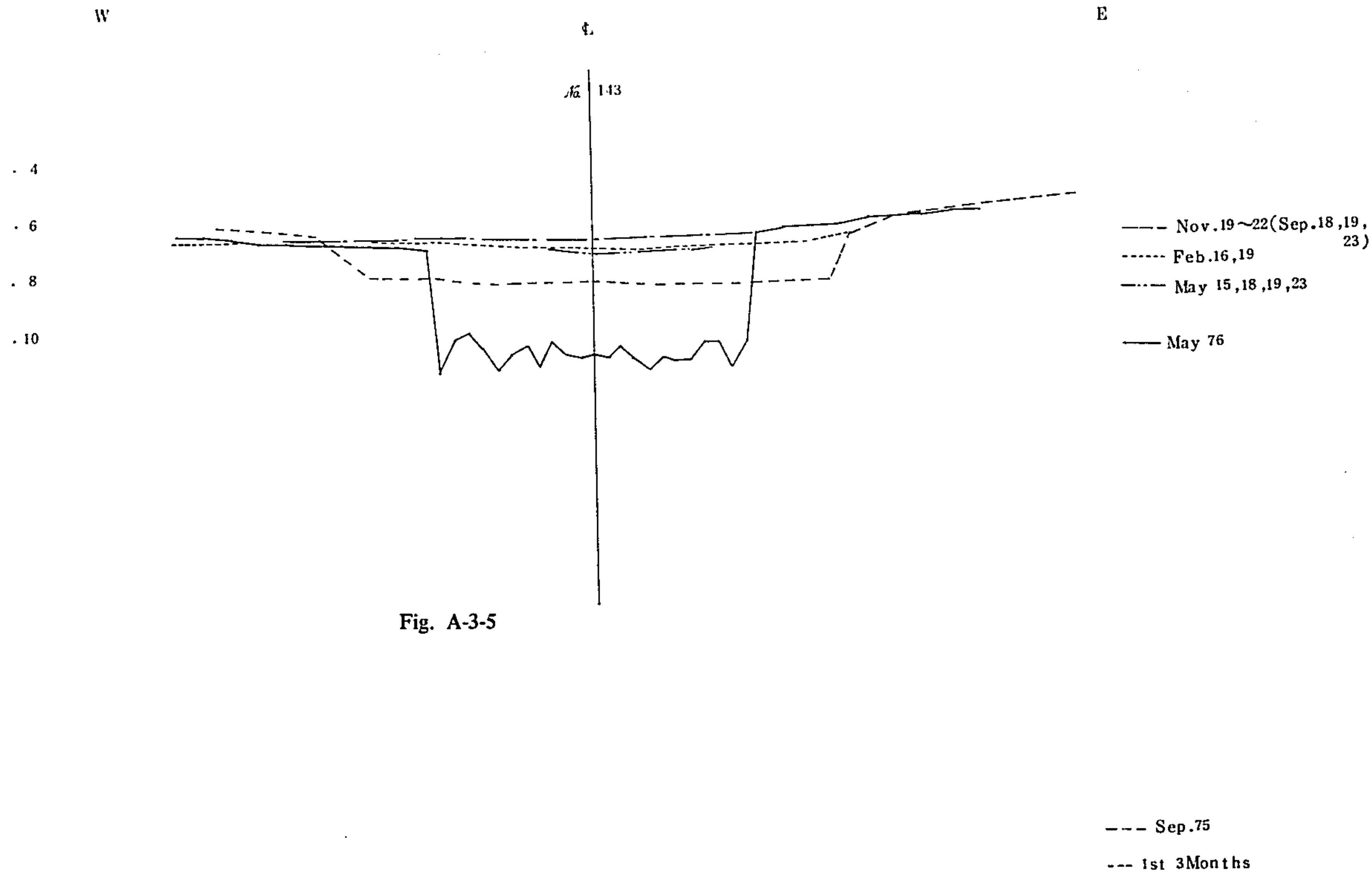

W
℄
E
No. 80
No. 90
No. 100
No. 110
·4
·6
·8
Dec 20,21,22
Jan 22,23
Feb 12
May 15,18,19,21,23
Aug 76
Dec 20,21,22
Aug 76
Nov.19~22,75
Aug 76
Oct.22,23,24
Nov.19
Feb.12
May 15,18,19,21,23
Aug 76

Fig. A-3-3



E
W
℄
No. 120
No. 129
No. 130
No. 140
.4
.6
.8
Oct.22,23,24
Aug.76
Sep.18,19,23
Aug 76
Sep.18,19,23
Aug 76
initial
Nov.19,'75(Sep.18,19,23)
Feb.12,15,'76
May 15~23,'76
Aug 76

Fig. A-3-4



W
E
℄
No. 143
. 4
. 6
. 8
. 10
Nov.19~22(Sep.18,19,23)
Feb.16,19
May 15,18,19,23
May 76
Sep.75
1st 3Months

Fig. A-3-5

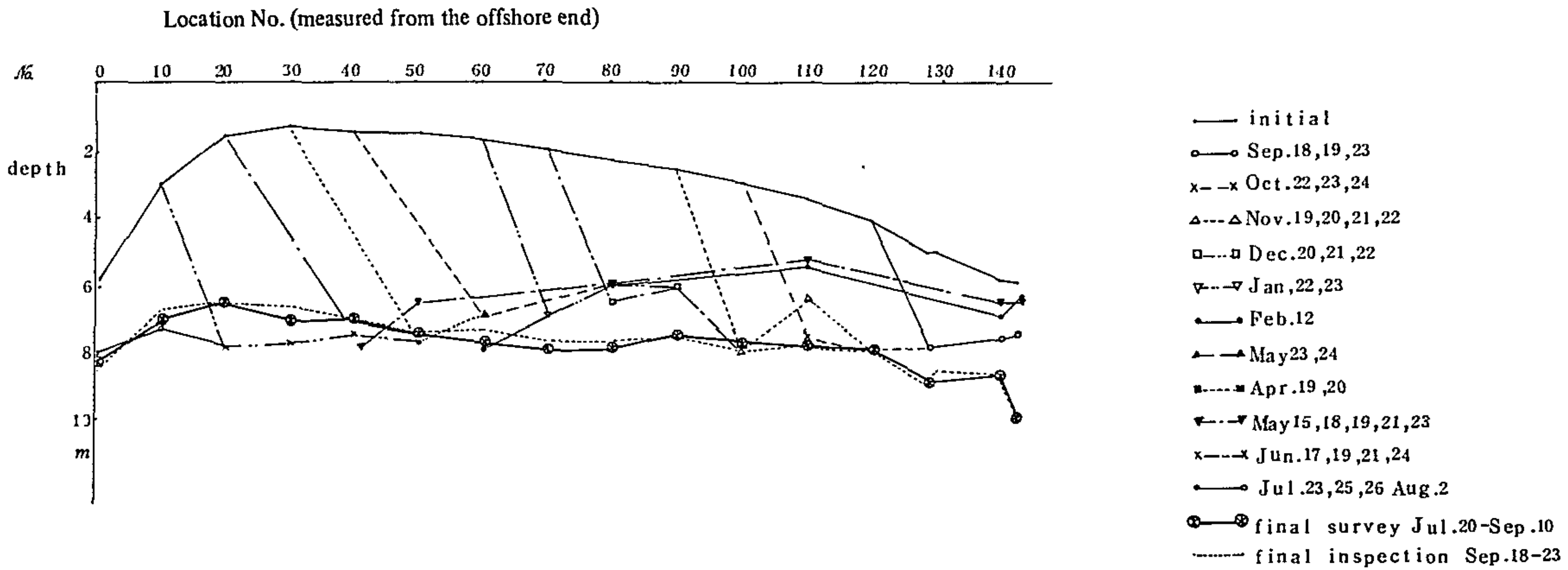


Fig. A-4 Monthly Change of Longitudinal Cross Section

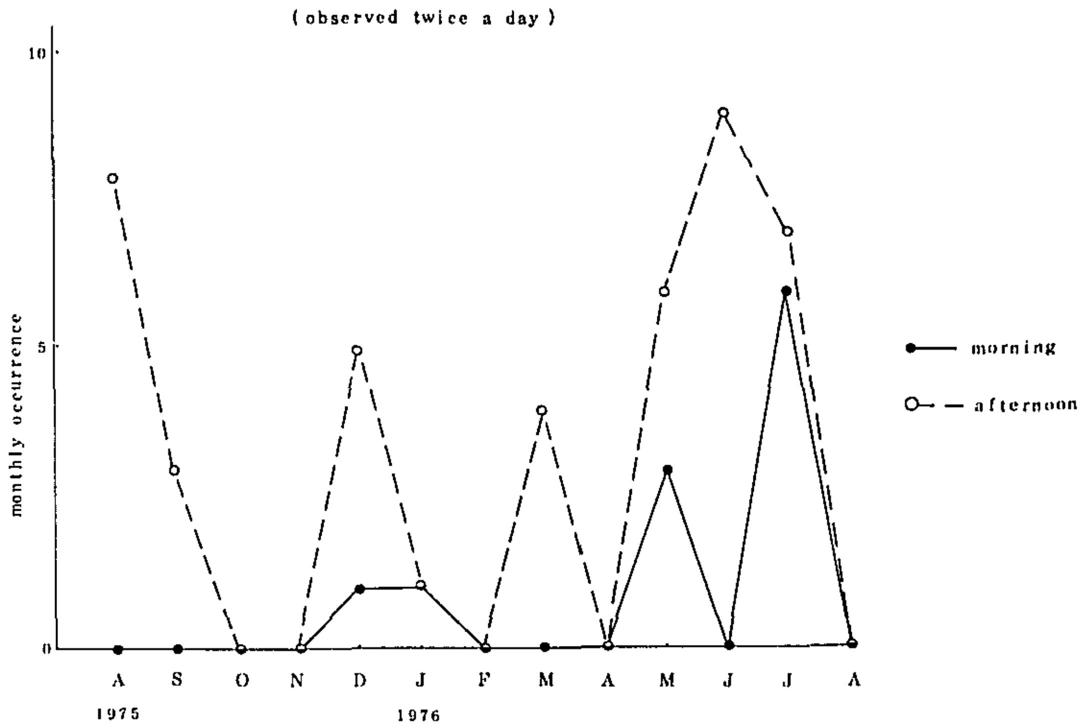


Fig. A-5 Monthly Occurrence of Wave Height above 1.0m

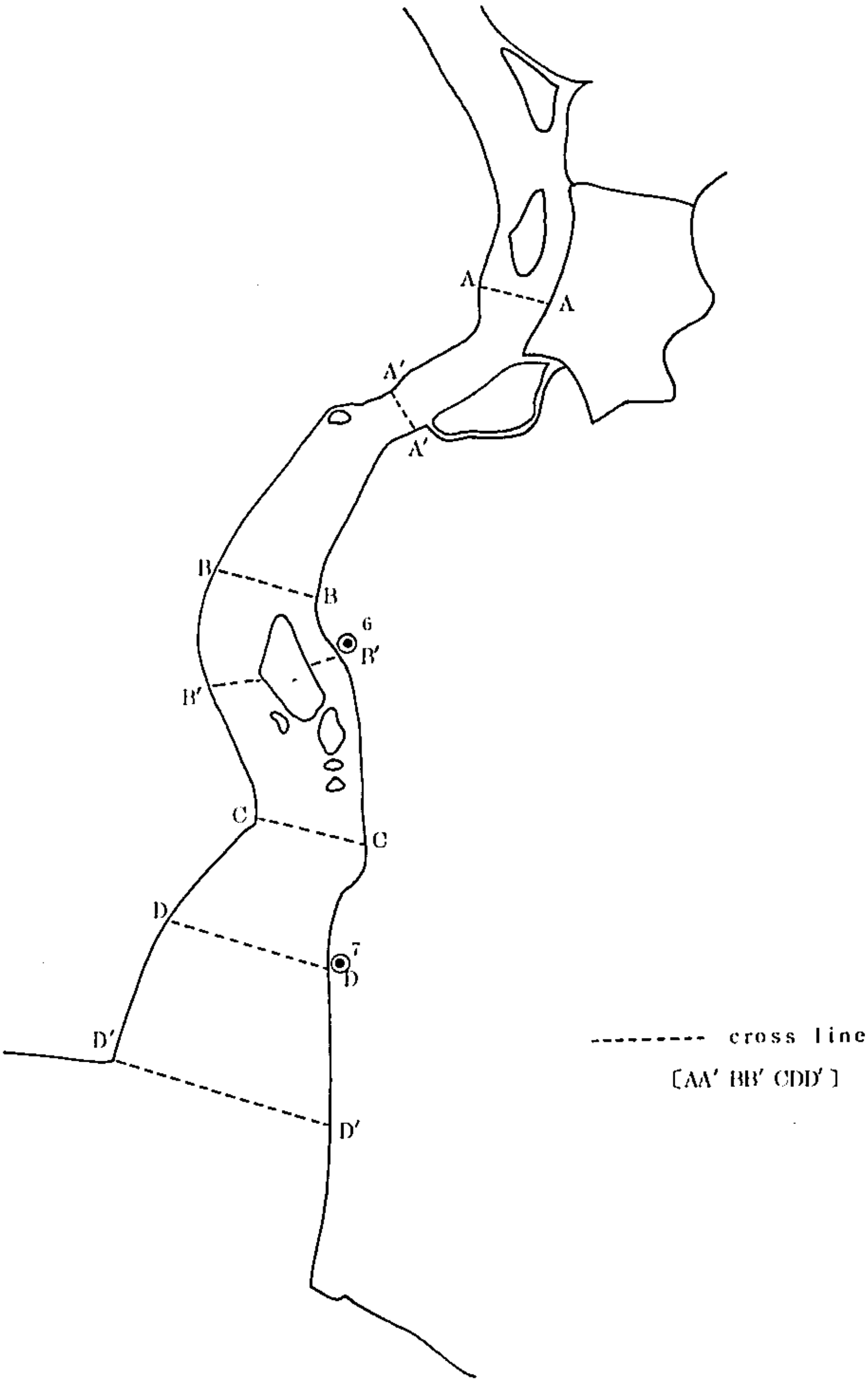


Fig. A-6 Cross Line A – D'in Barito River

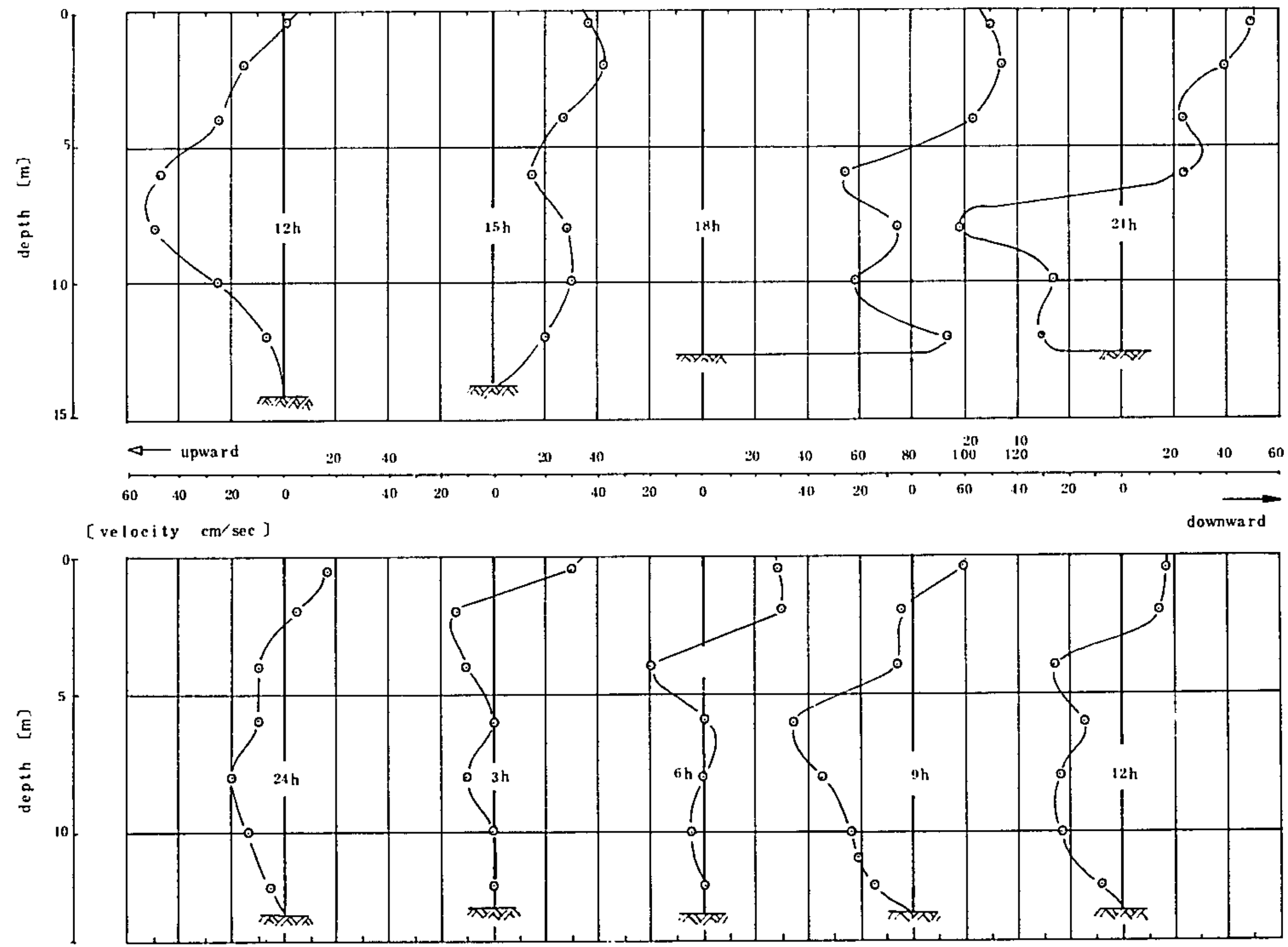


Fig. A-7 Vertical Distribution of Velocity at the Center of Line A
Aug. 2 to 3, 1976

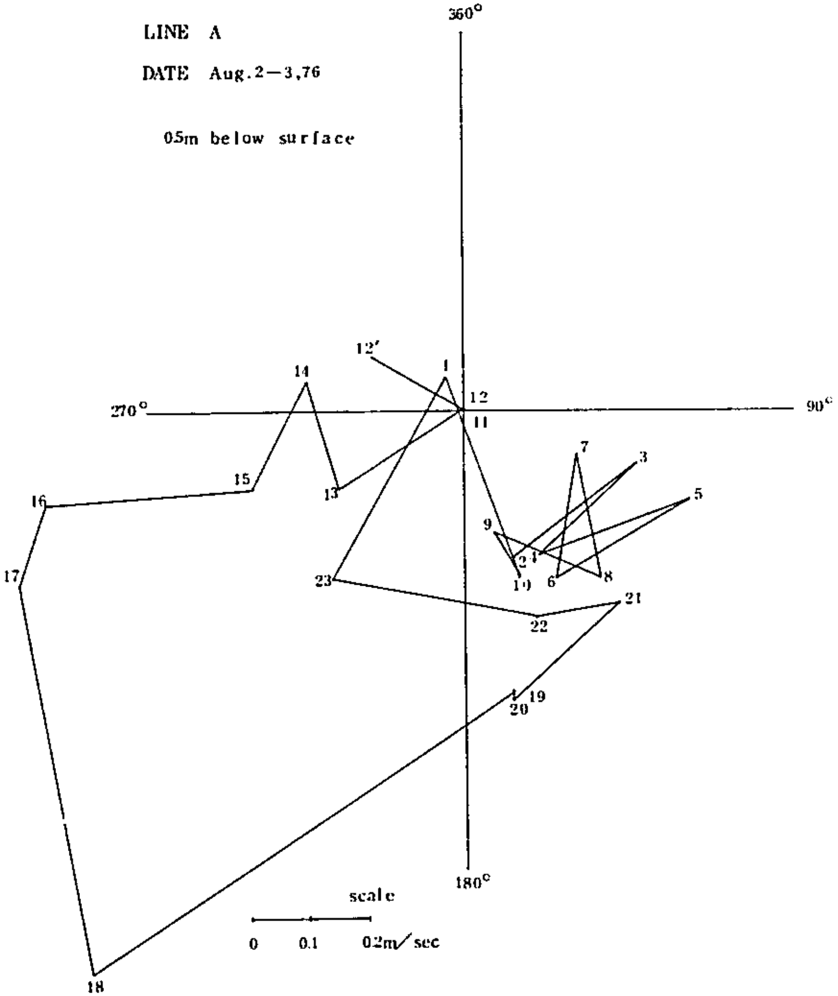


Fig. A-8 Current Diagram

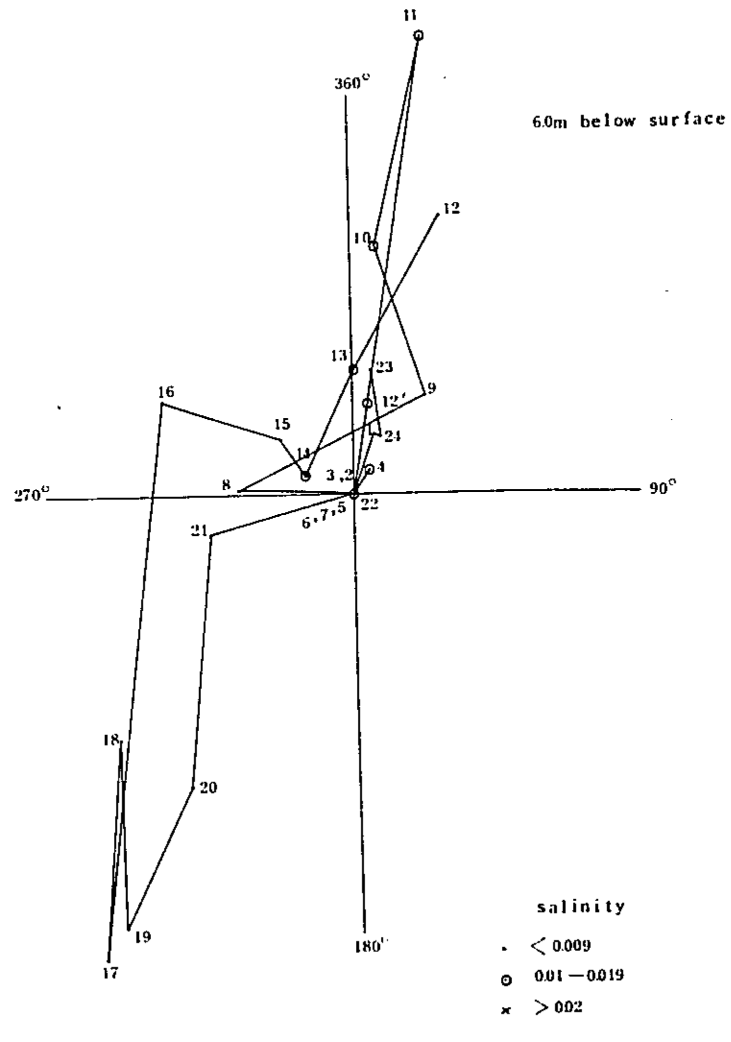


Fig. A-8-2

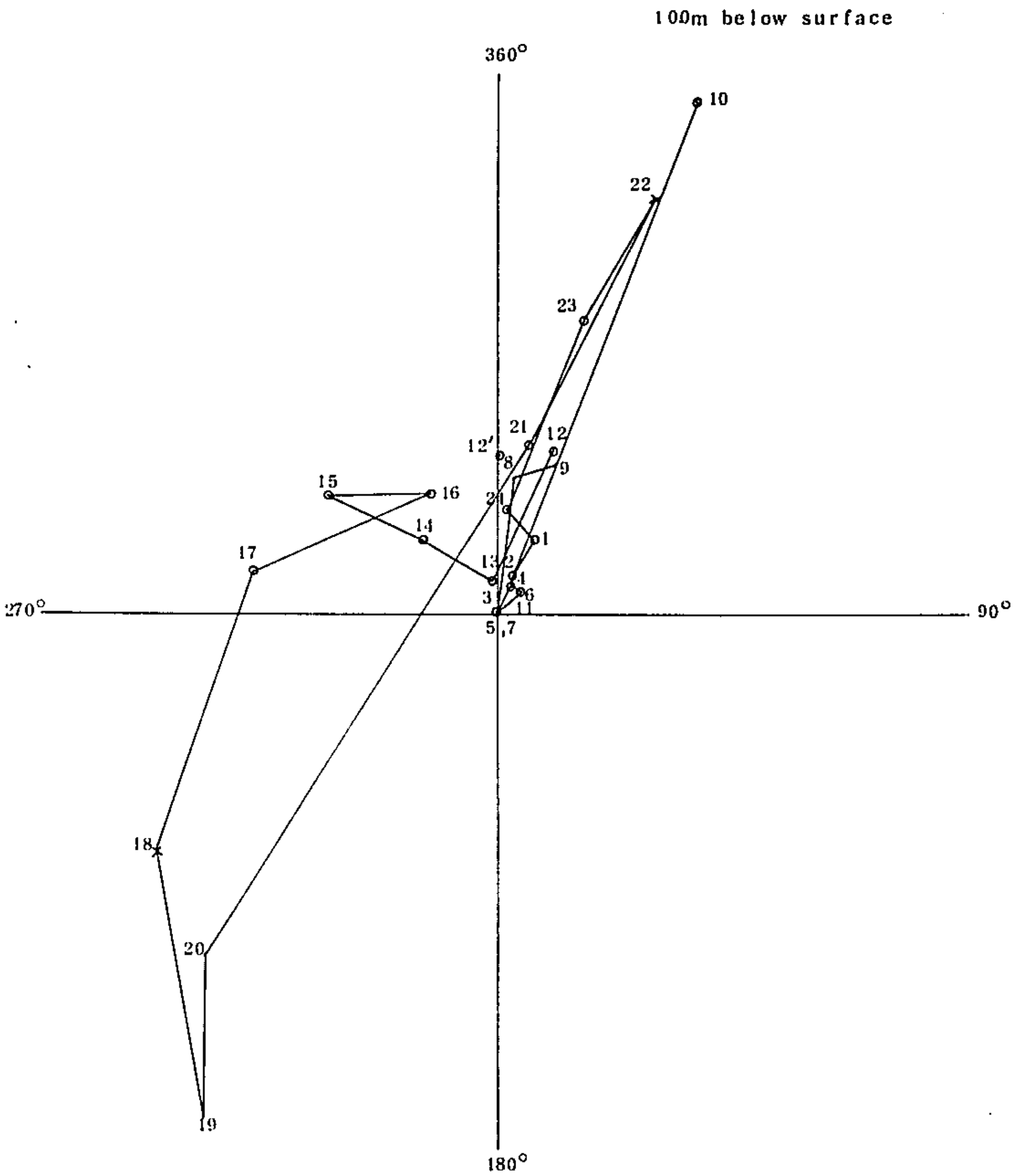

100m below surface
360°
270°
90°
180°
10
22
23
21
12
12'
8
9
15
16
24
14
1
17
13
2
4
3
6
11
5,7
18
20
19

Fig. A-8-3

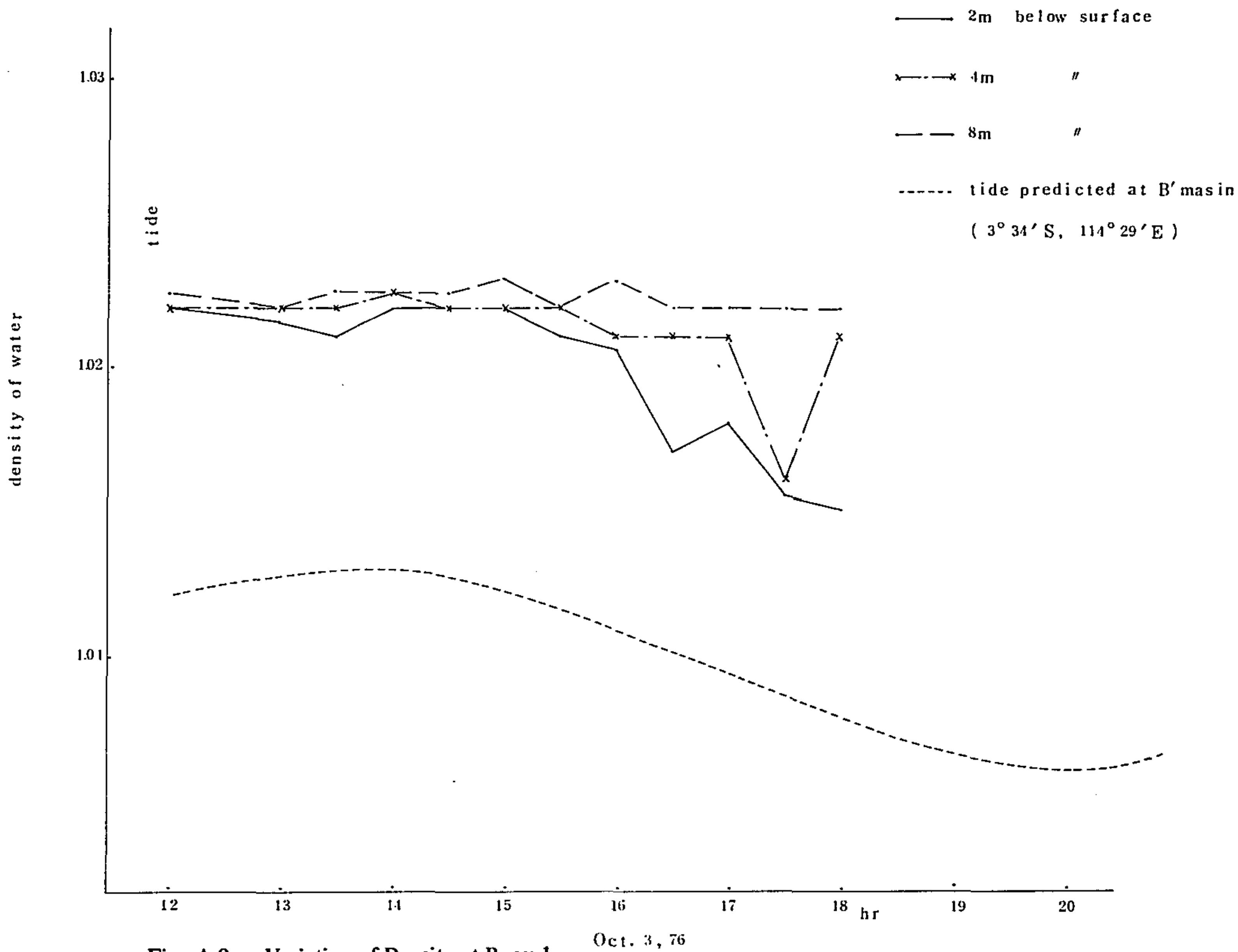


Fig. A-9 Variation of Density at Buoy 1

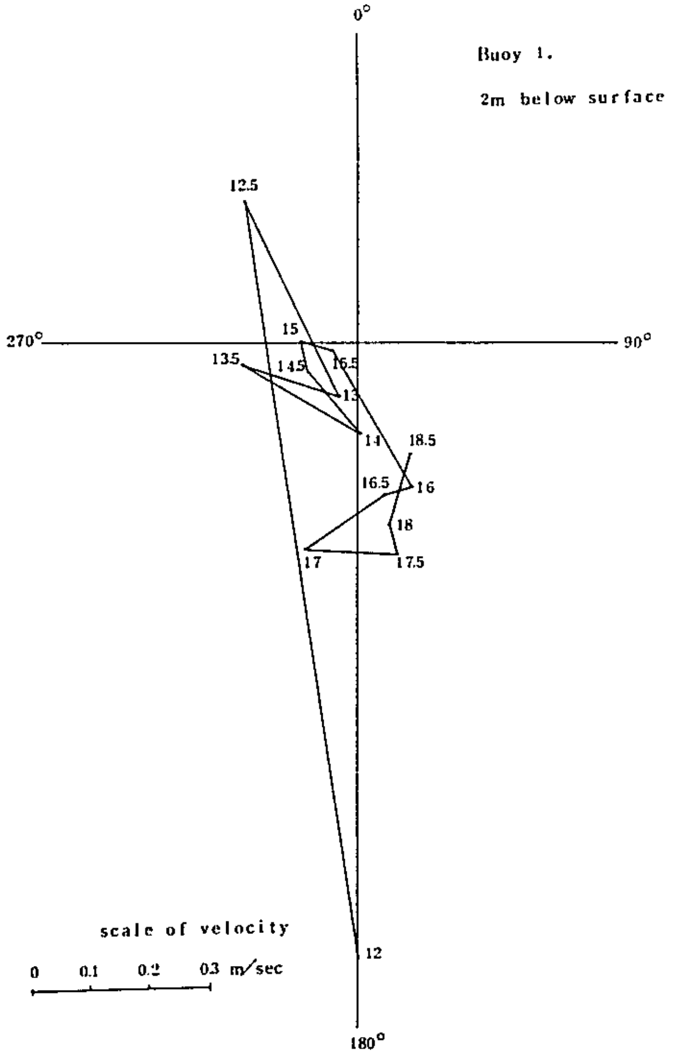


Fig. A-10 Current at the Offshore End of Channel

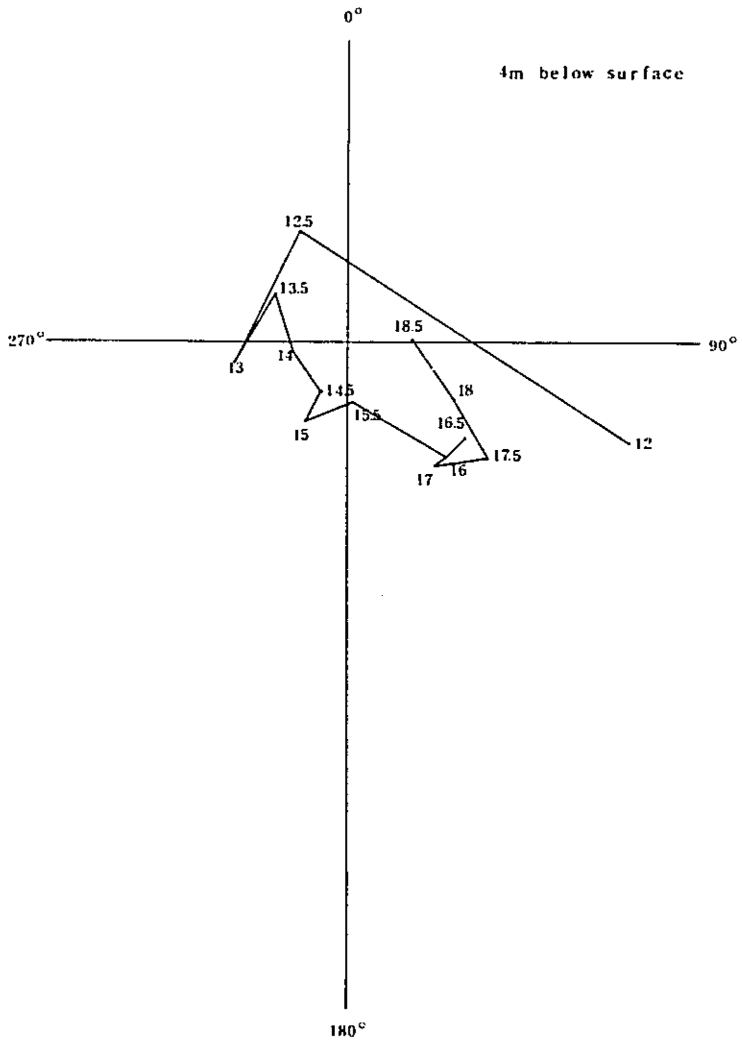


Fig. A-10-2

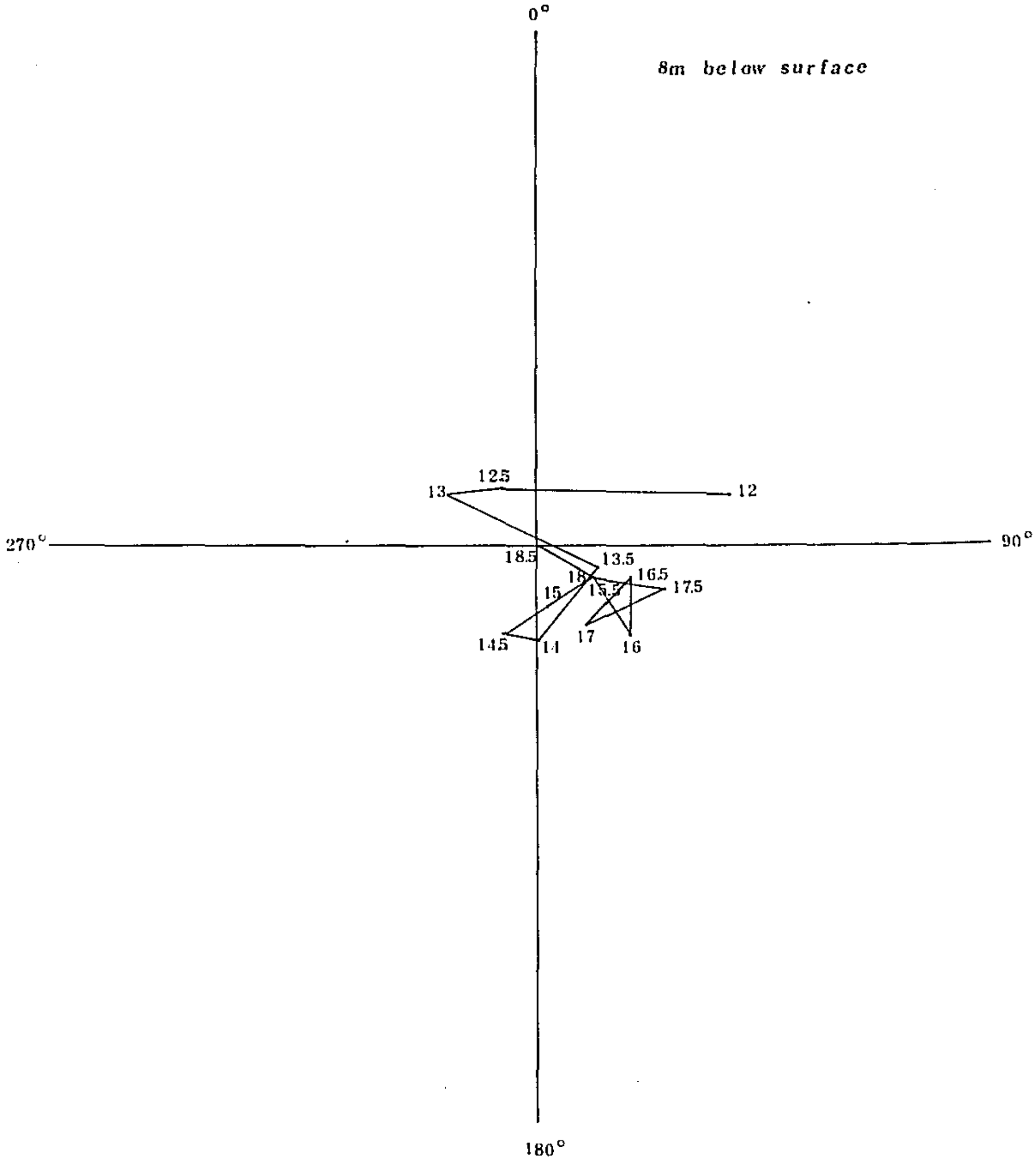

0°
8m below surface
12.5
13
12
270°
90°
18.5
13.5
18
16.5
17.5
15
15.5
17
14.5
14
16
180°

Fig. A-10-3

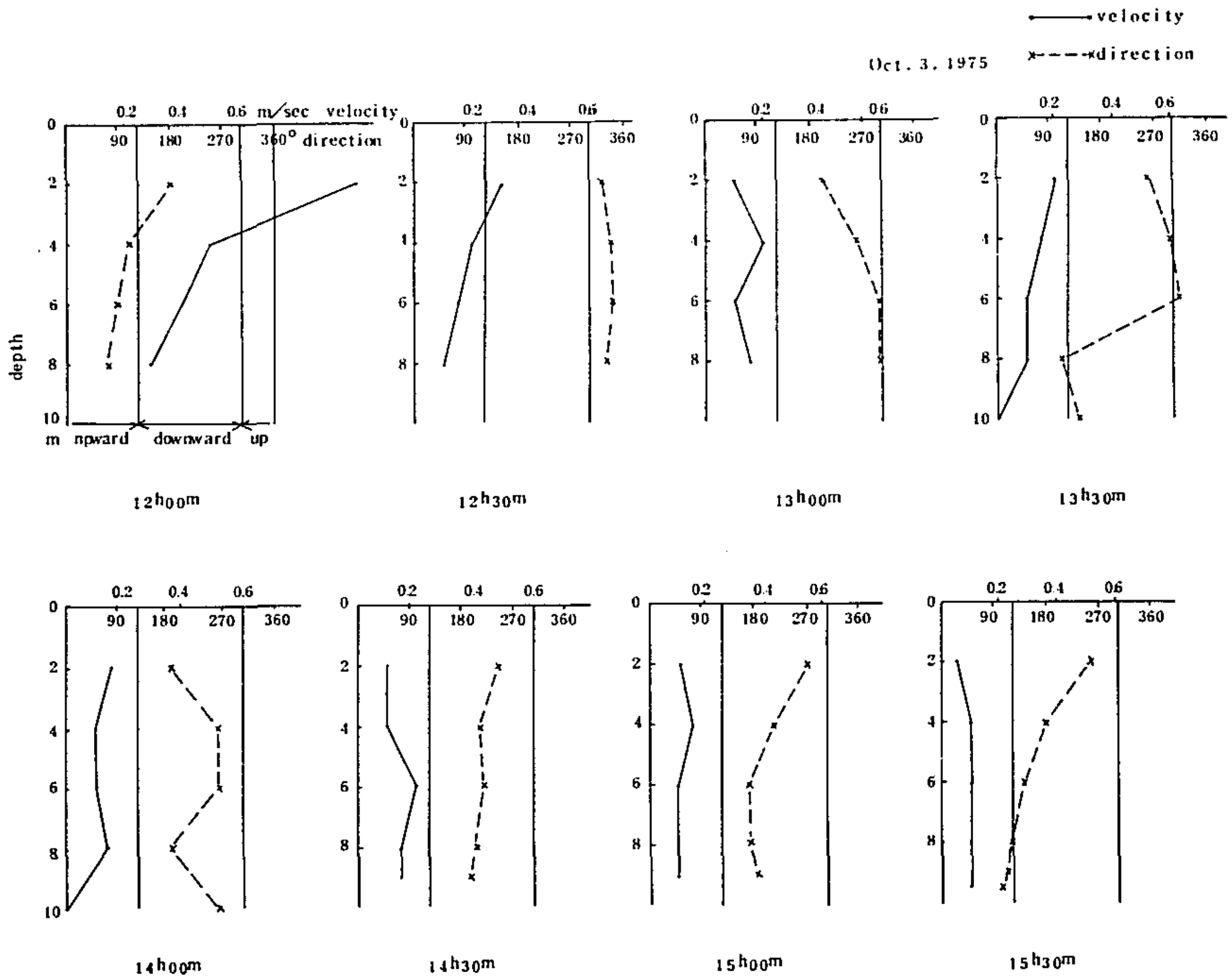
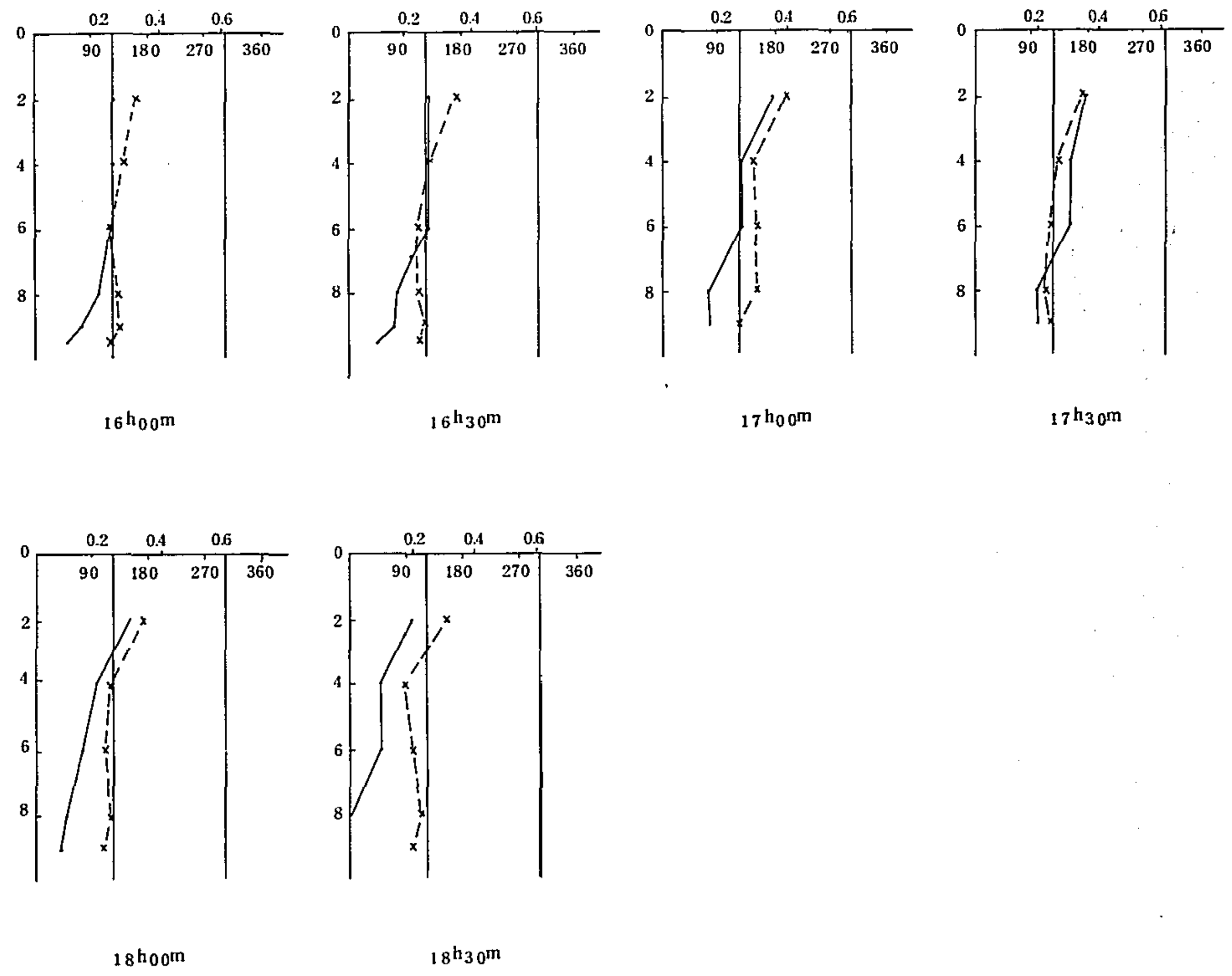


Fig. A-11 Current Observation at Buoy 1



0.2
0.4
0.6
90
180
270
360
0
2
4
6
8
16h00m
16h30m
17h00m
17h30m
18h00m
18h30m

Fig. A-11-2

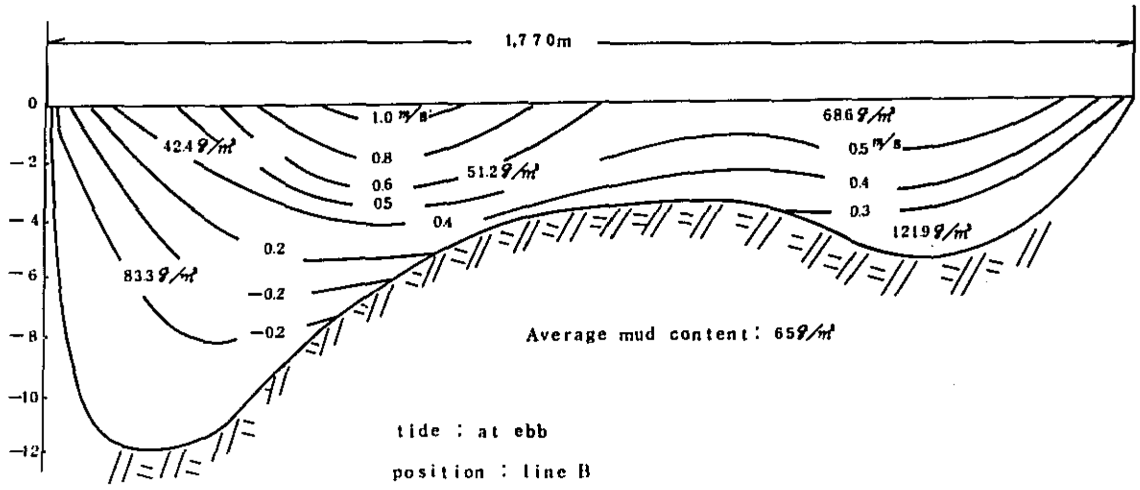


Fig. A-12 Current Velocity and Amount of Suspended Mud

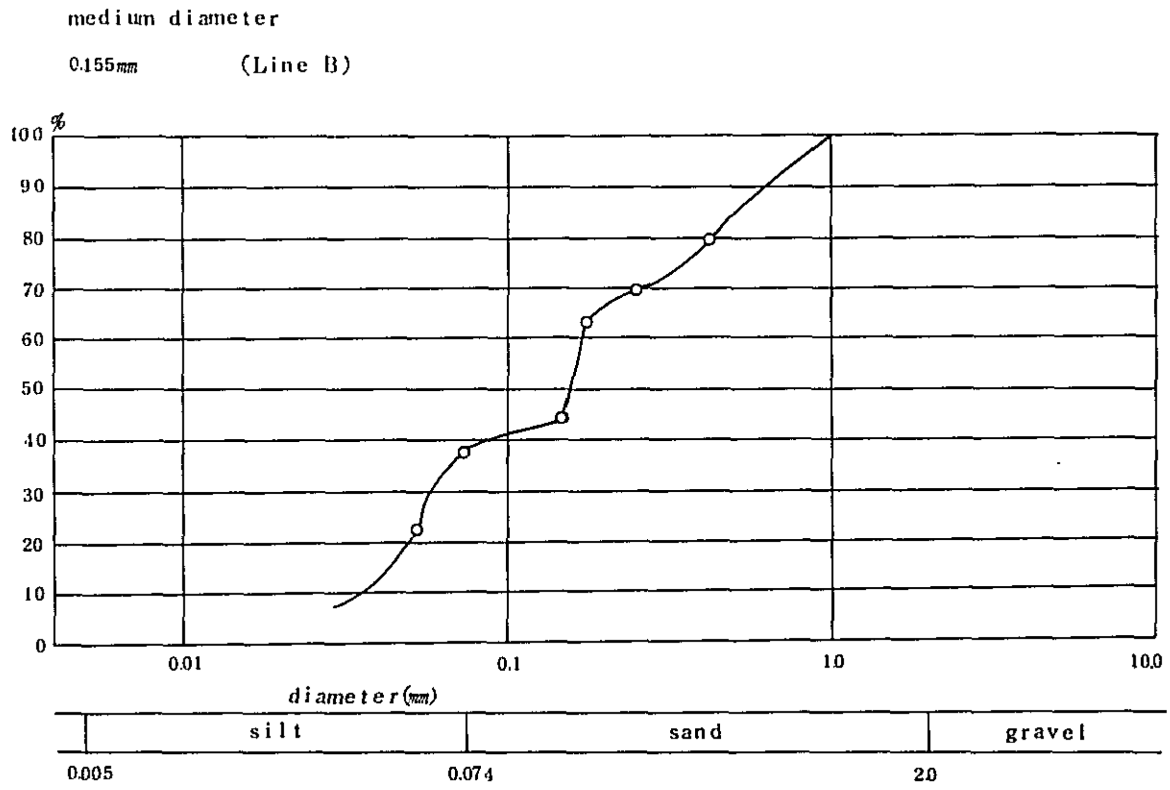


Fig. A-13 Accumulation Curve

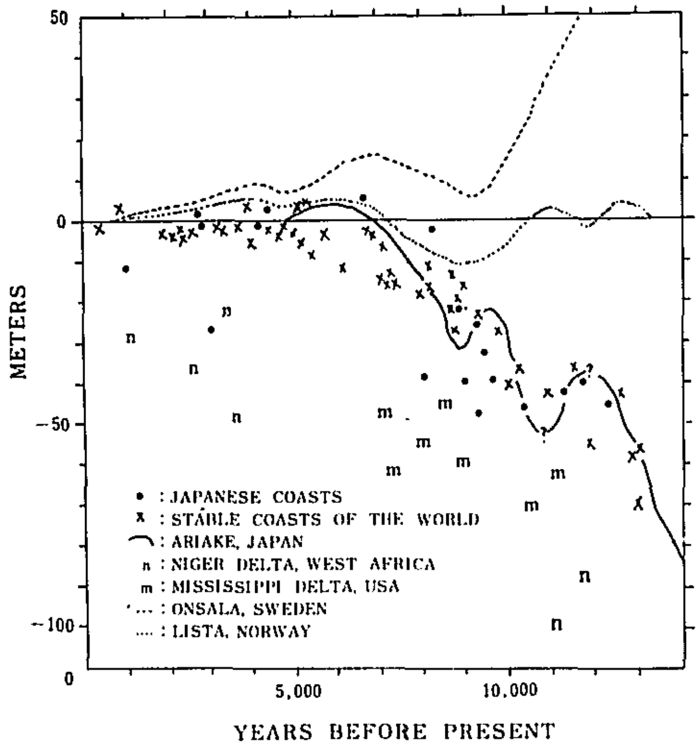


Fig. A-14 Height-Radiocarbon Date Relationship of Holocene Deposits