99. In Kabupaten Kolaka road, length is 3,693.66 km, the percentage of asphalt road is 19.21% or 709.7 km. The length of asphalt road in 1989 is 227.7 km, and increased to 482 km(211.68%) in 1990.

100. The number of vehicles in 1990 in this province is 304,05;, 26,528 are passenger cars, 6,225 mini-buses, 37,476 trucks, and 233,823 motorcycles. The number of vehicles in 1990 compared to 1989(315,303) decreased by 3.57%. In Kabupaten Kolaka the number of vehicles in 1990 is 2,677, 274 buses, 201 cargo-cars, 141 trucks and 2,677 motorcycles.

2-8-2 Transportation Activities

(1) Air Transportation

101. According to the O-D survey conducted by MOC in 1988, the volume of passenger transported by airplane is as follows.

Kot.Ujung Pandang - Kab.Kendari	15,560 persons/year
kot.Ujung Pandang - Kab.Muna	403 persons/year

102. Based on Air Transport Statistics(1990), traffic volume handled at Ujung Pandang are as follows;

Passenger	Departure	279,146	Cargo Loaded	10,111,399 kg
	Arrival	306,070	Unloaded	10,368,143
	Transit	266,807		

About 6% of Departure or 15,556 Passengers went to Kendari. 83,812 passengers went to Jakarta and 61,331 went to Surabaya.

(2) Sea Transportation

103. The present ferry operation is as follows:

number of ferry boats; 5 vessels(max 1000GRT)
number of trips daily; 5(night trip)
trip time; 9 hours

104. Almost all of the cargoes in this route are destined finally to Ujung Pandang and Kendari, but destination of passenger varies widely.

105. Referring to the interview survey, it has been suggested that ferry service should play an important role in development projects such as the irrigation project, for which some improvements are required on ship side and loading/ unloading facilities.

2-9 South Sumatra - Bangka - Belitung Route

2-9-1 Socioeconomic Features

106. This route is in South Sumatra Province. South Sumatra Province consists of 8 Kabupatens and Kot. Palembang. Proposed sites are located in kot. Palembang, Bangka island of kabupaten Bangka and Belitung island of Kabupaten Belitung respectively.

(1) Population

107. In 1986, the population in South Sumatra amounted to 5,672-thousand people, and in 1990 population reached 6,277-thousand people, an increase of 10.67% between 1980 and 1990, the average annual population growth of this province was 2.13%.

108. According to the Census of 1990, total population in Kotamadya Palembang was 1,144,279 people. In 1986, the population was only 849,412 people and the growth rate was 6.93% per year. The population growth rate in Kotamadya Palembang during 1989 - 1990 was 20.60%. Width of the area was 353.80 km^2, so the average density rate was 3,234.3 people per km^2.

109. The population in Kabupaten Bangka was 487,196 people consisting of 244,745 men and 242,451 women and an average density rate of 42.4 people per km^2. The population growth during 1986-1990 was 2.31% per year and during 1989-1990 was 6.42%. The population in Bangka island was 601,304 people, consisting of 301,330 men and 299,974 women and an average density rate of 51.87 people per km^2. The population growth during 1986-1990 was 2.07% per year and during 1989-1990 was 5.32%.

110. The population in Kabupaten Belitung was 188,996 people, consisting of

96,553 men and 92,443 women and an average density rate 41.56 people per km^2. The population growth during 1986-1990 was 1.09% per year and during 1989-1990 was 0.90%.

(2) Industry

111. The priority of both national and regional development is still focused in the agriculture sector. Production of this sector supports other sectors such as industry, trade. The percentage of the population employed in agriculture sector ranks first among the sectors. In food crops production, sawah paddy increased to 1,145,831 tons in 1989 from 1,110,557 tons in 1988.
Forestry production in 1989 increased. The sawn plywood increased to 229,378 in 1989 from 217,783 m^3 in 1988 and wood sawn increased by 4.64% to 770,281 m^3 in 1989 from 736,137 m^3 in 1988. The fishery in South Sumatra produced 130,898.2 ton in 1989 or increased by 2.69%. In the industry sector growth during 1983-1987 based on the constant 1983 prices registered 12.4%. The vital and strategic mineral material in South Sumatra is oil and natural gas, tin and coal. The mining and excavating sector in the South Sumatra frequency is very dominant. The production of white-tin increased by 4.64% during 1988-1989.

112. In the harvest of rice, vegetables and fruits in Palembang in 1990, it increased by 10.36% compared to 1989 or to 7,178.39ha from 6,504ha. For its production, it increased to 18.34% or to 27,391.26 tons from 23,146.36 tons.
Total fish production has greatly increased by 133.32% or to 7,630.70 tons in 1990 from 3,270.2 tons in 1989. Its value increased by 160.47%. Industry, in Indonesia in general and especially in Kotamadya Palembang economy, is an important sector and makes the biggest contribution to GRDP. In 1989, the growth rate was 8.09 % with oil and gas and 3.4 % excluding oil and gas. It was calculated based on constant 1983 prices. Its contribution to GRDP in 1989 was 46.03 % with oil and gas and 34.77 % excluding oil and gas.

113. In this area, main production was in the sector of industry and trade. At constant 1983 prices, trade(30.83%), followed by industry (28.82%) and mining(19.69%) made the biggest contributions to GRDP in 1989. The production in mining was white tin(20,927.5 tons), quart sand(12,140 tons) and kaolin(14,140 tons). In food crops production, sawah paddy was only 469 tons or 0.04% in this province.

114. At constant 1983 prices, the biggest contribution was trade(24.85%) and followed agriculture(17.73%), industry(14.43%) and mining(19.69%). The production in mining was white tin(4,957.4 tons), quart sand(223,479 tons) and kaolin(264,941 tons).

(3) Gross Regional Domestic Product (GRDP)

115. The South Sumatra's GRDP in 1989 reached 6,775,448 thousand rupiah, an increase of 744,817 thousand rupiah or 12.35% compared to 1988.
The economic growth of South Sumatra is provided by GRDP based on the constant 1983 prices. The South Sumatra's GRDP has increased continuously and has reached 4,627,873 thousand rupiah, an increase of 6.89% during the period of 1988-1989.

116. Oil has been a big part of their output and is transferred to the central government. The serial data without oil, the South Sumatra's GRDP has increase. The average growth of the GRDP without oil during the period of 1983-1989(=3,295,968 thousand rupiah) was 4.81%.

117. In Kabupaten Bangka, GRDP, including tin in 1989 based on the current prices, was 727,890 million rupiah. GRDP excluding tin in 1989 based on the current prices was 349,237 million rupiah. (See table 2-9-3§2-9-4)
In 1989 based on the constant prices of GRDP 1983, the productivity of 1989 (412,370 million rupiah) increased to 124.63% compared to that of 1983. The rate of development in the previous years in Kabupaten Bangka was as follows: 8.41% in 1988 and 6.30% in 1989. Excluding tin GRDP in 1989 was 153,203 million rupiah, an increase of 178.01% compared to 1983 and of 11.76 % compared to 1988 (137,081 million rupiah). The biggest contributor to GRDP including tin is the sector of trade, followed by industry and mining. The percentage of each sector was 30.81%, 28.82%, and 19.69% respectively. Excluding tin, trade accounted for 30.83% and agriculture for 34,96%.

118. In Kabupaten Belitung, GRDP including tin in 1988 based on the current prices was 127,845 million rupiah which meant that compared to 1983(62,845 million rupiah) it increased by 203.43%.
GRDP excluding tin in 1988 based on the current prices was 110,114 million rupiah. The growth of GRDP in 1988 increased by 12.71% compared to that of

1987. At constant 1983 prices(62,845 million rupiah), GRDP in 1988(83,319 million rupiah) increased by 132.58% compared to that of 1983. The rate of development in the previous years in Kabupaten Belitung was as follows: 10.51% in 1987 and 7.48% in 1988. Excluding tin GRDP in 1988 was 70,741 million rupiah. The biggest contributor to GRDP is the sector of trade. The percentage of the sector of trade was 25.46% and next was agriculture(20.88%).

(4) Road Conditions and Number of Vehicles

119. The type and length of road in 1989 are as follows: state-road- 1,017.80 km, provincial road- 2,18.10 km, and kabupaten road- 7,604.27 km.
Regarding the road surface, it was observed that 4,804.98 km or 42.75% is covered with asphalt, 1,973.53 km or 17.56% with gravel, 4,461.66 km or 39.69% earth.

120. In 1989 the length of the road network at the Kotamadya Palembang reached 295.973 km. In terms of the surface condition, 95.08% or 281,423km are asphalt, while 4.92% or 14,550km are earth.(See Table 2-9-8)

121. Road length in Kabupaten Bangka (1989) is 1,449.72 km. Concerning the road surface, 359.89 km or 24.82% is asphalt and 1,089.83 km or 75.18% is earth. In 1989, road length in Kabupaten Belitung was 573.40 km. Concerning road surface 232.75 km (40.59%) is asphalt road and 340.45 km (59.41%) is earth road.

2-9-2 Transportation Activities

(1) Air Transportation

122. According to the O-D survey conducted by MOC in 1988, the volume of passenger transported by airplane is as follows.

Palembang - Pankal Pinang	42,485 persons/year
Palembang - Tanjung Pandang	13,677 persons/year
Pankal Pinang - Tanjung Pandang	9,038 persons/year

123. Based on Air Transport Statistics(1990), traffic volume handled at Pankal

Pinang and Tanjung Pandang are as follows;

- Pankal Pinang -

Passenger	Departure	77,179	Cargo Loaded	1,170,447 kg
	Arrival	78,010	Unloaded	1,315,124
	Transit	8,056		

About 70% of departure passengers or 53,861 went to Jakarta, 16,865 passengers went to Palembang and 5,212 went to Tanjung Pandang. 18,688 arrival passengers came from Palembang and 6,204 came from Tanjung Pandang.

- Tanjung Pandan -

Passenger	Departure	39,989	Cargo Loaded	535,059 kg
	Arrival	38,964	Unloaded	360,330
	Transit	31		

About 70% of departure passengers or 27,824 went to Jakarta, 6,204 passengers went to Pankal Pinang and 5,231 went to Palembang. 5,500 arrival passengers came from Palembang.

(2) Sea Transportation

1) South Sumatera-Bangka

124. The present ferry operation is as follows:
number of ferry boats; 2 vessels(about 150GRT)
number of trips daily: 2(night trip)
trip time: 12 hours

125. Sometimes it arrives late at Kayu Arang or is forced to call at Muntok Port when the tidal level is low and the ferry cannot pass through the mouth of Jering River or because of dense fog. (Since the ferry service started in 1986 with new mooring facilities, dredging has not been executed around the mouth of Jering River.)

126. In October, 1990, a high speed passenger boat with the capacity of 68 persons started operation between Palembang Port and Muntok Port; the distance between Palembang and Muntok is about 60 miles and the trip time is three hours. In November 1991, three passenger boats started operations. General cargo ships are transporting passengers on this route. According to the data, about 66,000 passengers/one way/year move between Palembang and Bangka Island, the

share of passengers transported by ferry is about 45%.

2) Bangka-Belitung Route

127. The existing ferry route between Bangka Island and Belitung Island connects Pangkal Balam and Tanjung Pandan. On both sides, there are not any exclusive facilities for ferry operation.

128. The present ferry operation is as follows:

number of ferry boat	2 vessels
one of which is used when the other is docking	
trip frequency(weekly)	4(night trip)
trip time	16 hours
distance of route	110 miles

129. The number of passengers is nearly 90 persons per one trip on both sides and if the capacity is assumed to be 146 persons (the capacity of the larger ferry boat operated in this route), the load factor is about 60 %. The number of vehicles(4-wheels) is only one unit per one trip on both sides.

130. A passenger boat LINA operates two round trips a week, the same as the ferry between Pangkal Balam and Tanjung Padan. Another passenger boat operates among Pangkal Balam, Tanjung Pandan and Jakarta. The number of passengers transported by passenger boats is nearly equal to that by ferry boats.

The construction of a specialized ferry port was strongly requested in the interview survey.

PART 2

MASTER PLAN
ON NATIONWIDE FERRY SERVICE

Photograph of Mokmer

Chapter 1 Basic Ideas for Ferry Service Development Plan

1-1 Basic Concept of Ferry Service Development

1-1-1 Basic Requirements of Ferry Service

1. The following factors are generally proposed for basic requirements of ferry service, and they can also be recommended in the development of ferry service in Indonesia.

(1) Frequent Shuttle Service

2. For short-distance routes, daily or more frequent service with a moderate sized boats should preferably be introduced although ferry operating bodies tend to pursue operating efficiency by using bigger boats.

(2) Conveniently Scheduled Sailing Service

3. Sailing schedule should be planned according to the characteristic or the role of each route. Time schedule of ferry service should be set considering users' purpose and favorable schedule for passengers'/cargoes' transportation including the case of night trips.

(3) Regular Service

4. Ferry transportation users expect regularity of service. In case of a daily service route, departure and arrival time should respectively be fixed at the same time every day and should not be irregularly or arbitrarily changed. In case of a weekly service route, departure and arrival days should be set on the same day of the week rather than on different days of the week.

(4) Punctuality of Service

5. Ferry users expect to have a quick and on-time door-to-door cargo transportation service provided by taking advantage of role-on role-off system of ferry service. For this reason, introduction of a ferry boat with sufficient capacity which ensures a steady navigation regardless of weather or sea condition, such as wind, wave, or current, is very important.

(5) Comfortable and Safe Sailing

6. On most of the study routes, passengers will be the main object of transportation and the route distances are relatively long. Comfort and safety of sailing is an essential requirement. Special attention should be paid to the condition of ferry accommodations in case of nighttime service route.

(6) Moderate(Low)-Priced Service

7. Ferry service is requested to be introduced as a basic means of the regional transportation for local inhabitants. To play this role, the price of ferry service should preferably be offered at a moderate level. For this reason, there might be the need for the government to subsidize ferry operations to some extent, when necessary.

(7) Accessibility to Ferry Terminal

8. To ensure really convenient door-to-door transportation, the location of the ferry terminal is a very important factor. Generally speaking, a ferry terminal should be located at the point closest to the center of the origin/destination of the transportation demand. By planning the ferry terminal in this way, total transportation time can be saved and convenience of the trip can also be improved.

1-1-2 Roles of Public and Private Sector in Ferry Service

9. At present, the shipping operations are performed by the Perum ASDP(public corporation) and 15 private companies. On the other hand, the management and operation of ports are performed either by MOC or by the Perum ASDP. The construction of ferry port terminal facilities are under the responsibility of MOC.

10. Since private companies have participated in the comparatively profitable routes, the number of passengers transported by private shipping companies already exceeds twice of that transported by the Perum ASDP. This shows that the private companies are playing the important roles in the ferry service.

11. In the case of the existing routes, although a participating private company will have to run business in competition with the Perum ASDP and/or other private companies, it is important for the government to give permission to the private company to introduce private funds to this field as much as possible.

12. In Indonesia, the development of ferry transportation is considered as a extended part of road transportation, and is given a position as one of the important infrastructures. Especially, the development of ferry transportation in eastern Indonesia has a role to promote rectifying the unbalanced living standard between the eastern and the western part of Indonesia, thus becoming an important government policy. The Perum ASDP, as a public corporation, assumes a task of spearheading the government policy. Granting this role of the Perum ASDP, the government regularly gives ferry boats to the Perum ASDP without charge. It is considered that this kind of government aid will and should continue.

13. The Perum ASDP has another role as coordinator of any kind of problems that arise among companies and so on. Though the Perum ASDP is an organization of public nature, the Perum ASDP as a company is undoubtedly the leader among ferry operating companies. Therefore, it is strongly required that the Perum ASDP conducts fairly his task to meet and coordinate requests from/to regional governments and the central government as a mediator of ferry companies.

14. In a country like Indonesia comprising innumerable islands, because the supply of ferry boats tends to insufficiently meet the demand, the selection and prioritization of port construction sites is a matter of prime importance. This is an important task of the central government in the course of developing the ferry transportation network in the nation.

15. The tariff for the ports of MOC is determined lower than tariffs for the ports of the Perum ASDP in most cases. This is meaningful in that the lower tariff is regarded as a kind of financial aid for shipping companies.

1-2 Basic Concept of Ferry Service

1-2-1 Basic Concept of Ferry Network

16. The ferry service has been provided so far mainly in the area including Flores and Timor Islands, while long-haul ferry lines connecting each of main islands together - inter-regional ferry service - do not exist at present. In that sense, the real nation-wide network has not yet been realized.

17. Judging from the existence of substantial automobile/passenger traffic flowing continuously through the existing network, the most active regional network is the one which connects each of islands in series from Sumatra to Timor extending over around five-thousand kilometers. This is because the network connects the Island of Jawa which is the political and economic center of the nation with many of the other major cities and tourist spots from west to east, and because the islands on the network with relatively well developed national highways are located in a row with relatively short distance between each other. In this sense, this network is considered the most appropriate to make the best use of the ferry service from the viewpoint of social and economic development of the nation.

18. The other networks located in the regions of Kalimantan, Sulawesi, Maluku and Irian Jaya have not yet been developed sufficiently and are in a less active state compared with the above-mentioned Sumatra-Timor network in terms of the volume of automobile/passenger traffic. Viewed from the geographical condition and the distribution of social/economic activities to those regions, the expansion and strengthening of the regional networks should be stressed especially in the eastern regions such as Sulawesi, Maluku and Irian Jaya which have rather been left behind in the social/economic development. In those regions the ferry service should also be provided to surrounding small islands to solve the problem of isolation.

19. According to the O-D survey conducted by MOC in 1988, a triangular network formed by connecting Jawa, Kalimantan and Sulawesi should be given priority with comparatively less importance on the route of Kalimantan-Sulawesi in terms of providing inter-regional ferry service.

20. The characteristics of ferry service are enabling quick delivery of cargoes and willful travel of passengers. From this viewpoint, the long-haul ferry service should be launched only after careful examination of real demand for passenger and cargo traffic considering the existing services provided by conventional type of vessels for passenger and cargo traffic without vehicles. Leaving aside the ferry service in the above-category, there might be sea-highway type of ferry routes which will contribute to decreasing the traffic burden to existing highways. The ferry routes connecting Berawan, Palembang, Jakarta and Surabaya would be worth considering in future.

1-2-2 Classification of Ferry Route

21. Classification of ferry route according to functional characteristics:

1) Accessibility to Provincial Capital

A) National Route:

A ferry route located on the route having direct accessibility to provincial apitals on both ends

B) Regional Trunk Route:

A ferry route located on the route having direct accessibility to a provincial capital on one end

C) Regional Route:

A ferry route located on the route having no direct accessibility to provincial capitals

2) Demand Level

I) High Demand Route:

A ferry route providing service of more than six trips/day in terms of 300-500 GRT boat

II) Medium Demand Route:

A ferry route providing service between two and six trips/day in terms of 300-500 GRT boat

III) Low Demand Route:

A ferry route providing service of less than two trips/day in terms of 300-500 GRT boat

22. Classification of Ferry Route According to Geographical Characteristic:

1) Inter-regional Route:

A route connecting different regions, which tends to be a long-haul route, i.e. Java-Kalimantan, Java-Sulawesi etc.

2) Inter-island Route:

A route connecting different islands within a region, which includes a route serving remote islands

3) Short-cut Route:

A route which helps to shorten a land transportation distance, which are expected to be developed more in Sulawesi and Halmahera, i.e. Bajoe-Kolaka

4) Inland Route:

A route located in the inland area, which serves to cross rivers and lakes

1-2-3 Characteristics and Roles of Ferry Service on the Study Routes

23. The nine study routes are practically divided into 13 individual routes and their general characterization is presented in Table 1-1, in which three kinds of characterization are shown.

Table 1-1 Characteristics of the Planning Routes

Characteristics	Route Number												
	1	2-1	2-2	3-1	3-2	3-3	4	5	6	7	8	9-1	9-2
A: Route Category													
A-1: National Route											○		
A-2: Reogional Trunk Route	○											○	
A-3: Regional Route		○	○	○	○	○	○	○	○	○			○
B: Distance Type / Service Type													
B-1: Long Distance / Nighttime Serv.			○			○					○	○	○
B-2: Short Distance / Daytime Serv.	○	○		○	○		○	○	○	○			
C: Transportation Type / Demand Type													
C-1: Connecting with Prov. Cap. City	○										○	○	
C-2: Connecting with Local City		○	○	○	○	○	○	○	○	○			○

Note:

1. Route 1: Ambon Isl.(Hunimua) ~ Seram Isl.(Waipirit)
   Route 2-1: Biak Isl. ~ Yapen Isl.
   Route 2-2: Yapen Isl. ~ Irian Jaya(Nabire)
   Route 3-1: Flores Isl. ~ Adonara Isl. ~ Lomblen Isl.
   Route 3-2: Alor Isl. ~ Pantar Isl.
   Route 3-3: Flores(Larantuka) ~Alor(Kalabahi)
   Route 4: Sulawesi ~ Kabaena
   Route 5: Kabaena ~ Muna
   Route 6: Sulawesi ~ Wawoni
   Route 7: Morotai Isl. ~ Halmahera Isl.
   Route 8: Sulawesi(Bajoe) ~ Sulawesi(Kolaka)
   Route 9-1: Sumatra(Palembang) ~ Bangka Isl.
   Route 9-2: Bangka Isl. ~ Belitung Isl.

Chapter 2 Development Ideas for the Study Ferry Routes and the Evaluation of the Alternatives for Ferry Terminal Sites

1. The study Team conducted a field reconnaissance survey to make the development plan of nine ferry routes and to select the most suitable terminal sites. The main items to have been surveyed are oceanographic conditions, topographic conditions, accessibility from/to main cities and road condition and land condition.(See Table 2-1) The routes 1, 8 and 9 are now operated and the change of terminal site is not required in four terminals in Routes 1 and 8, Larantuka and Karabahi terminals in Route 3 and Palembang terminal in Route 9; description is omitted here on the result of field reconnaissance survey at these terminal sites.

2-1 Biak-Yapen-Irian Jaya Route

2. Two ferry route alternatives are considered to connect the three islands, of which Biak Island should serve as a base port(Biak city is the social and economic center in the region), 1) a route connecting Yapen and Irian Jaya directly with Yapen(this alternative does not connect Yapen with Irian Jaya) and 2) a route connecting three regions in which Yapen island serves as an intermediate port. Here the alternative 2) is selected because the three regions are connected with each other by ferry service.

3. Two terminals in Yapen Island are constructed on the northern coast to connect with Biak Island and on the southern coast to connect with Irian Jaya.

4. In Biak Island side, three candidate terminal sites were evaluated. Mokmer was selected because of the good access road condition and the short distance to the center of Biak city although oceanographic conditions are nearly the same in all three candidate sites.(See Fig. 2-1)

5. On the northern coast of Yapen Island, two candidate terminal sites were evaluated, 1) Yobi which is the only existing village along the northern coast and 2) Saubeba with which a road now under construction connects Serui, the center of this island. Saubeba was selected because of its good accessibility to Serui, easy preparation of land for terminal and more favorable oceanographic conditions (See Fig. 2-2)

Table 2-1 Evaluation for Ferry Terminal Site Selection

Route No	Location	Nama of Site	Accessi-bility	Land Condition	Sea Condition	Evaluation
1	AMBON	Hunumua	B	A	A	A
	SERAM	Waipirit	A	A	B	A
2	BIAK	Mokmer	A	B	B	A
		Parai	B	C	B	B
		Mandon	C	C	B	C
	NORTH YAPEN	Yobi	C	B	C	C
		Saubeba	B	A	B	B
	SOUTH YAPEN	Turu	A	C	B	B
		Kabuaena	B	B	A	A
		Pasar Ikan	A	C	B	C
	IRIAN JAYA	Nabire	A	B	C	C
		Kimi	B	B	A	A
3	FLORES	Larantuka	A	B	A	A
	ADONARA	Wailebe	C	B	A	C
		Terong	B	A	A	A
		Waiwerang	A	C	B	C
		Riangderi	C	B	A	C
	LOMBLEN	Lewoleba	A	A	A	A
		Balauring	B	B	A	B
		Wairiang	C	C	B	C
	PANTAR	Baranusa	A	B	A	A
	ALOR	Karabahi	A	A	A	A
4	SOUTHEAST SULAWESI	Banbaea	A	B	C	C
		Pulemo	B	A	B	A
	WEST KABAENA	Sikeli	A	B	A	A
5	EAST KABAENA	Toli Toli	B	C	A	B
		Dongkala	A	B	A	A
	MUNA	Mawasangka	A	B	C	B
6	SOUTHEAST SULAWESI	Kendari	A	B	A	A
	WAWONII	Langgara	A	B	B	A
7	HALMAHERA	Tobelo	A	C	B	C
		Gura	A	A	B	B
		Gorua	A	A	A	A
		Galela	C	B	C	C
	MOTOTAI	Daruba	A	A	B	A
8	SOUTHEAST SULAWESI	Kolaka	A	B	B	A
	SOUTH SULAWESI	Bajoe	A	A	C	A
9-1	SOUTH SUMATRA	Palembang	A	A	A	A
	WEST BANGKA	Kayu Arang	B	B	C	B
		Muntok	B	A	B	A
9-2	EAST BANGKA	Ketapan	A	C	A	B
		Batu Beriga	B	B	C	C
		Sadai	A	B	A	A
	BELITUNG	Tg. Binga	A	C	C	C
		Tg. Pandan	A	C	B	B
		Tg. Barong	B	B	A	A
		Teluk Gambira	C	A	C	C

A: Good B: Fair C: Poor

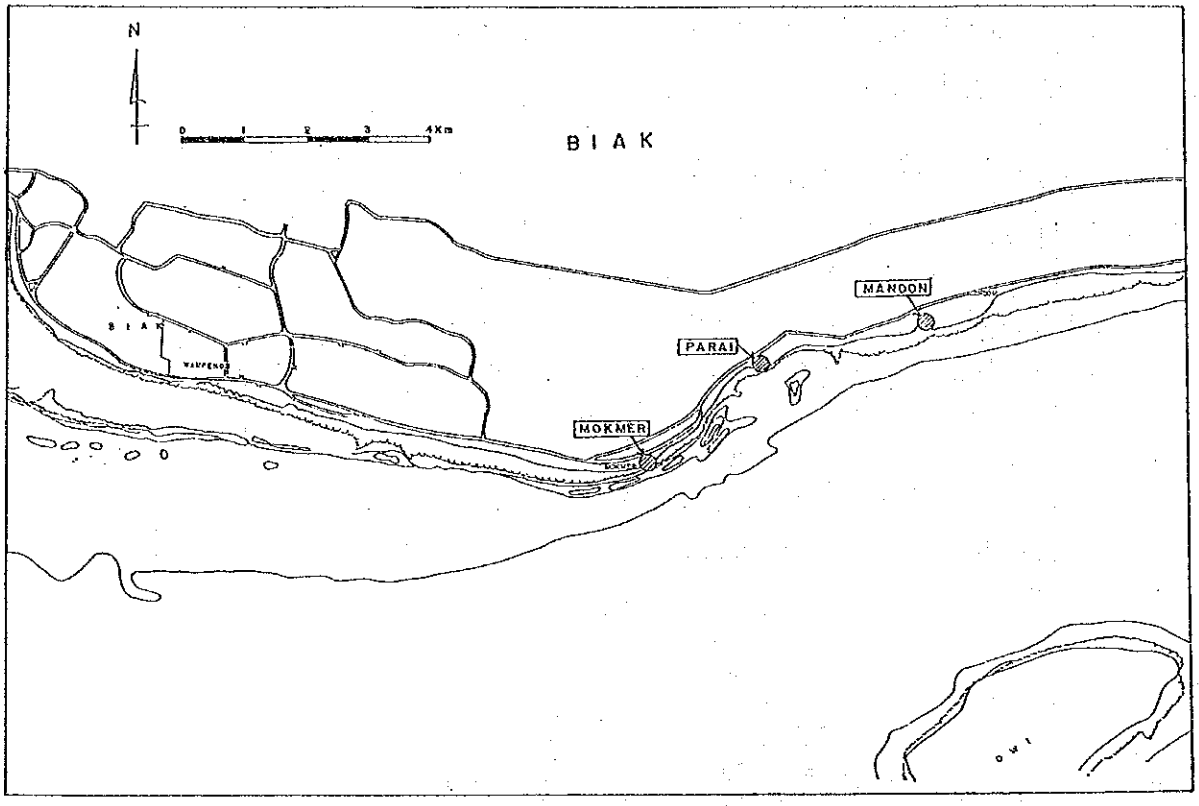


Fig. 2-1 Terminal Site Alternatives in Biak Isl.

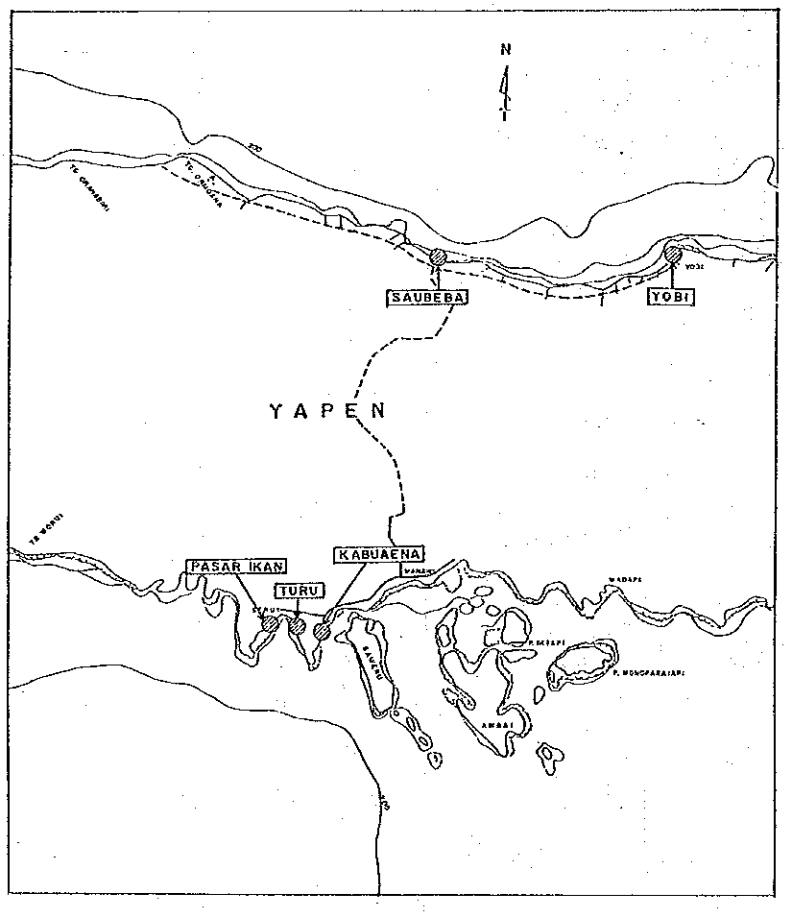


Fig. 2-2 Terminal Site Alternatives in Yapen Isl.

6. On the southern coast of Yapen Island, three candidate terminal sites were evaluated. Kabuaena was selected because of its good oceanographic condition (protected well against waves) and easy acquisition of land for terminal although accessibility to Serui is not good compared with the other two sites.(Fig. 2-2)

7. In Irian Jaya side, two candidate terminal sites were evaluated, Nabire, the center of this region and Kimi 24km, away from Nabire. Kimi was selected because of good wave condition and easy acquisition of land for terminal although accessibility is slightly worse.(See Fig.2-3)

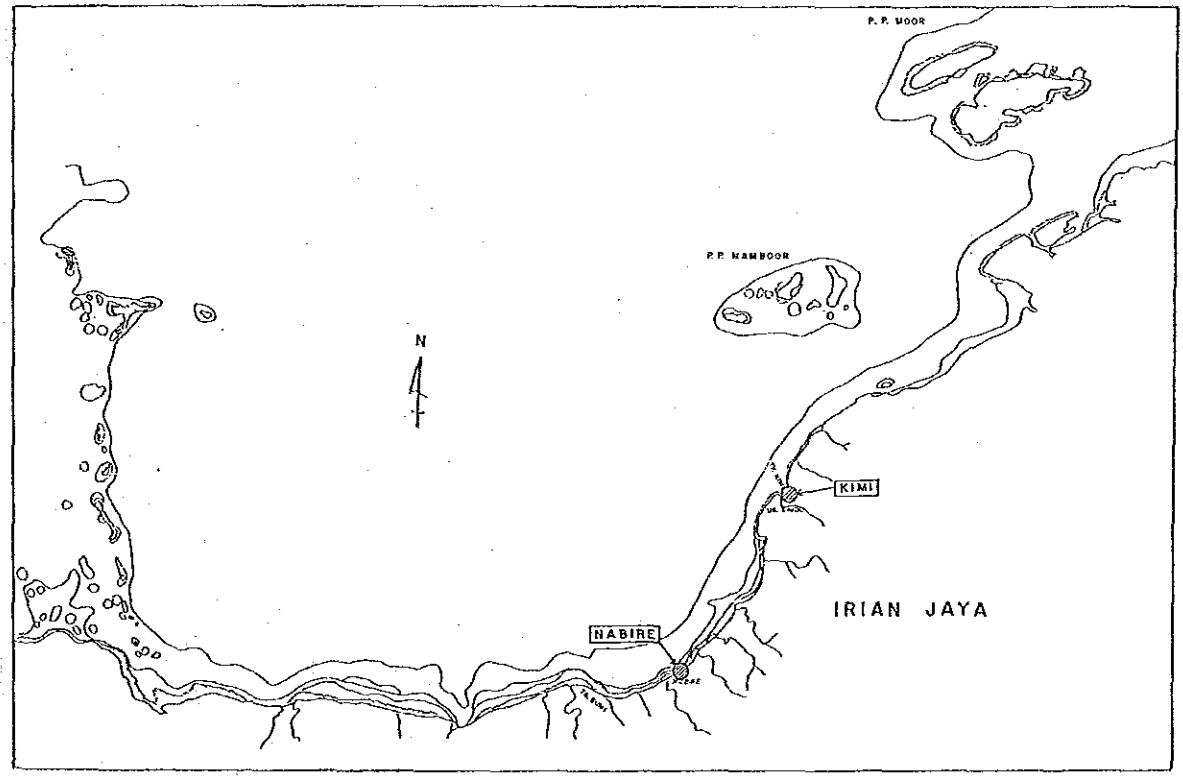


Fig. 2-3 Terminal Site Alternatives in Irian Jaya

2-2 Flores-Alor Route

8. In Adonara Island, four candidates ferry terminal sites were evaluated, Wailebe in the west end of the island, Terong and Waiwerang along the southern coast of the middle part of the island, and Riangderi in the east end of the island. In Waiwerang, there is a wharf for passenger transportation from/to Larantuka but it is difficult to obtain land for ferry terminal. Terong was selected because of its topographic conditions and easy acquisition of land although oceanographic conditions for all three candidate sites are nearly same.(See Fig. 2-4)

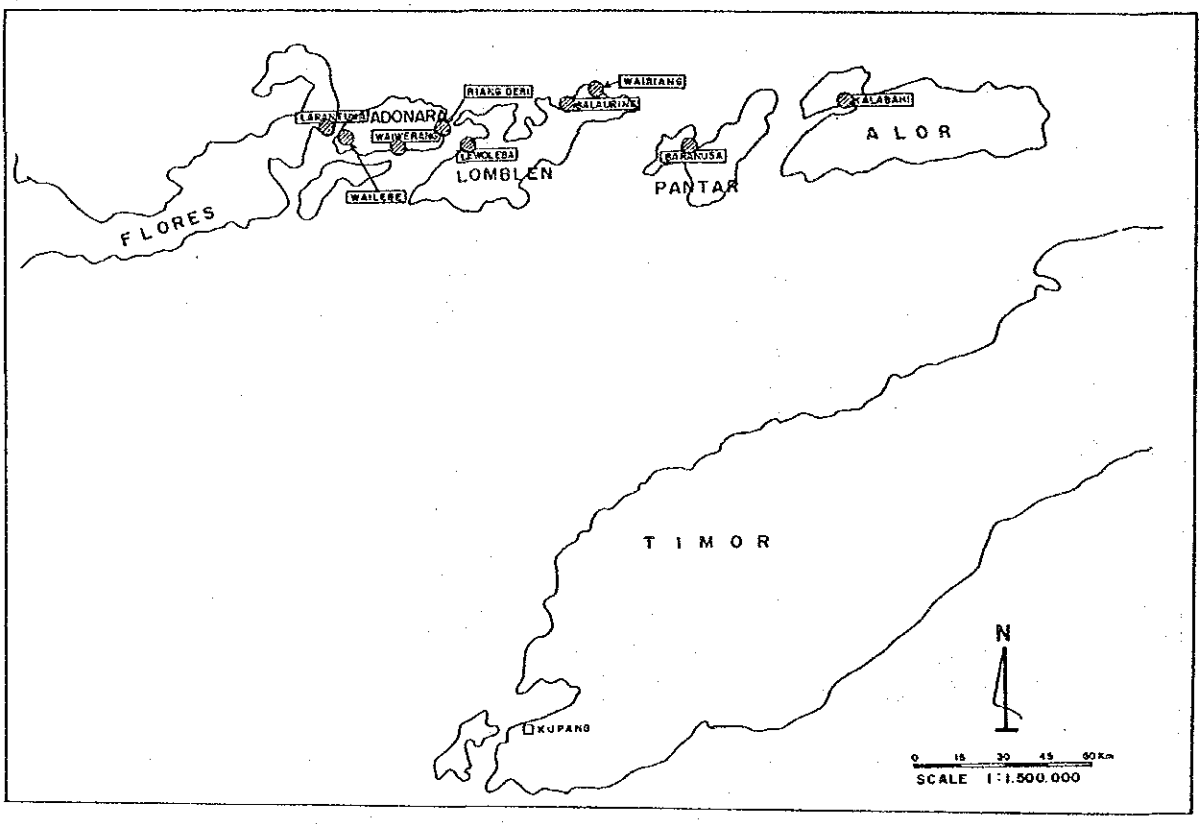


Fig. 2-4 Candidates of Ferry Terminal Site Between Flores Isl. and Alor Isl.

9. In Lomblen Island, three candidates ferry terminal sites were evaluated, Lewoleba, located at the middle part of the island and two sites located along east coast of the island. Lewoleba was selected because of its good accessibility, favorite oceanographic conditions and easy acquisition of land compared with the other sites.

10. In Pantar Island, only Baranusa was evaluated. Although it has some problems for land acquisition for ferry terminal, the other two items were highly evaluated.

11. Larantuka terminal in Flores Island and Karabahi terminal in Alor Island are now in operation or under construction. The facilities in the terminals are sufficient in capacity for the Master Plan.

2-3 Southeast Sulawesi-West Kabaena Route

12. In Southeast Sulawesi side(Sulawesi main island), Banbaea, which measures the shortest distance from Kabaena Island and Pulemo, located next to Banbaea, were evaluated. Although Banbaea has good accessibility to Bajoe, Pulemo was selected because of its favorable wave condition and easy acquisition of land for terminal.

13. On the west coast of Kabaena Island, it is easy to obtain land for ferry terminal next to Sikeli sea port, a good natural port. Mooring facilities will be constructed at a short distance from the beach. Sikeli was selected for terminal site in West Kabaena.

2-4 East Kabaena-Muna Route

14. On the east coast of Kabaena Island, Dongkala and Toli Toli were selected for candidate terminal sites. Although the two sites are protected well against waves, Dongkala was selected because of the surrounding topographic condition of the site where terminal is planned.

15. In the west coast of Muna Island, rubble mound jetty exists at Mawasangka, located at the shortest distance from Dongkala. Mooring facilities were planned the tip of the extended existing jetty.

2-5 Kendari-Wowonii Route

16. In Kedari, the capital of Southeast Sulawesi Province, possible candidate terminal sites are limited by the existence of a sea port and a fishery port and topographic conditions. It is possible to construct new mooring facilities for ferry at an appropriate water depth by extending the existing jetty which is now utilized for sea transportation with Wowonii Island.

17. In Wowonii Island side, it is possible to construct a jetty with a short distance to install mooring facilities with sufficient water depth at the tip of the jetty. Land for ferry terminal will be prepared by reclamation of the coast next to the new jetty.

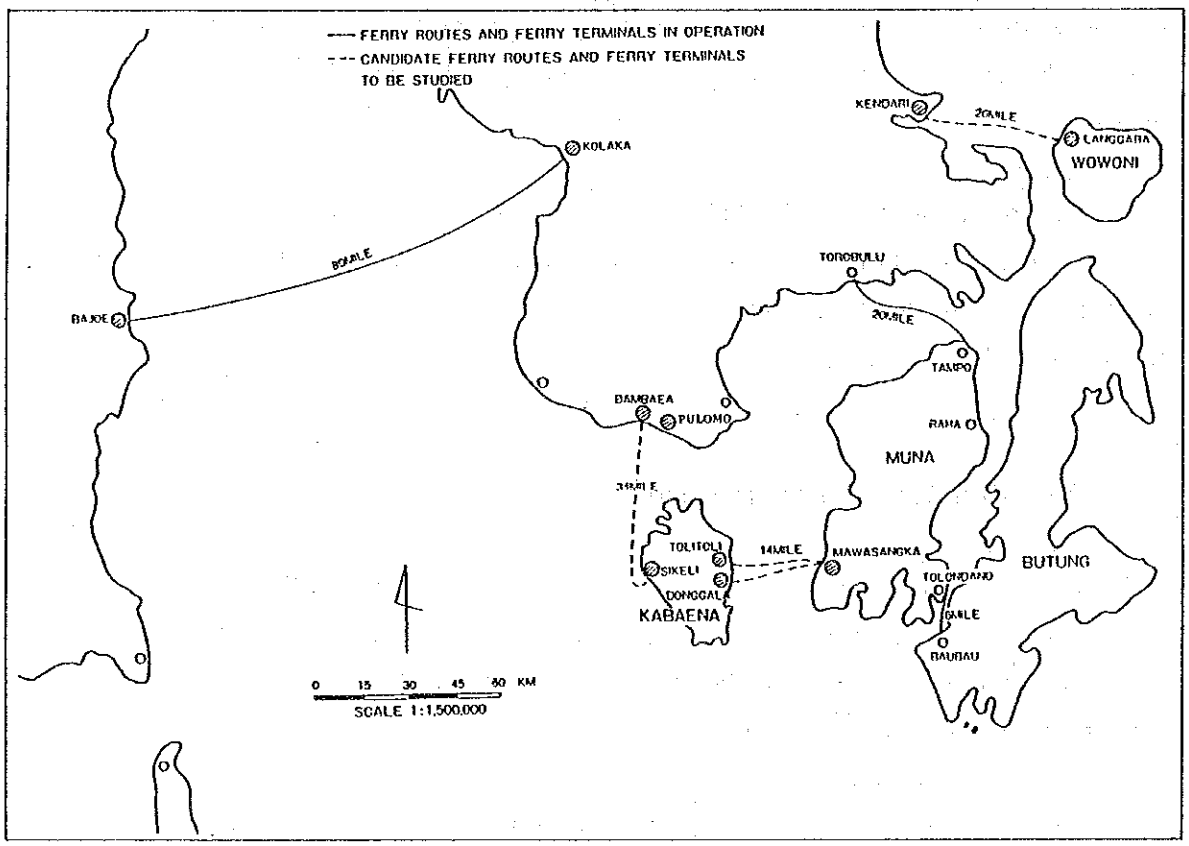


Fig. 2-5 Ferry network of Route-4,5,6 and 8

2-6 Morotai-Halmahera Route

18. In Morotai Island side, it is possible to utilize the land in Daruba owned by the local government for ferry terminal. In addition, it is a short distance from the center of Darube, therefore it was selected as the terminal site.

19. In Halmahela Island side, four candidate terminal sites including Tobelo, the center of the region, were evaluated. At the candidate site of Tobelo which has good accessibility, it is difficult to construct a terminal because of the existence of residences next to the site. Among the other three terminals, Gorua which lies half-way between the other two sites, was selected because of current land use condition and oceanographic condition(protection against waves).

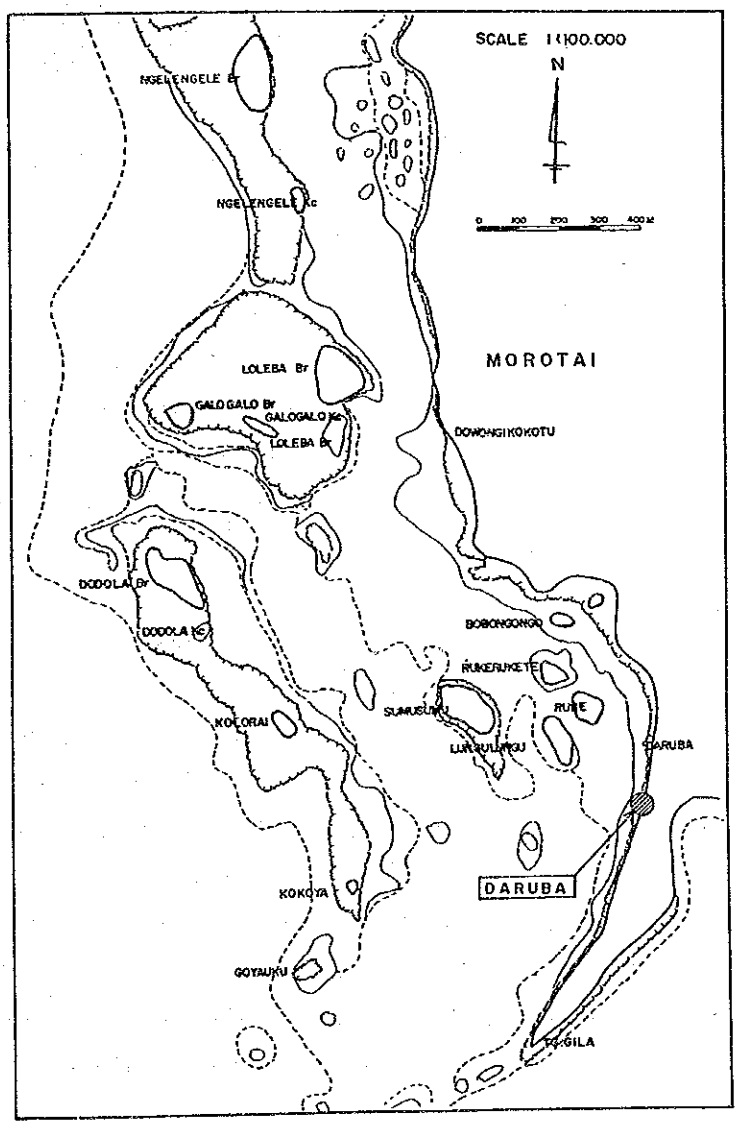


Fig. 2-6 Terminal Site in Daruba, Morotai Isl.

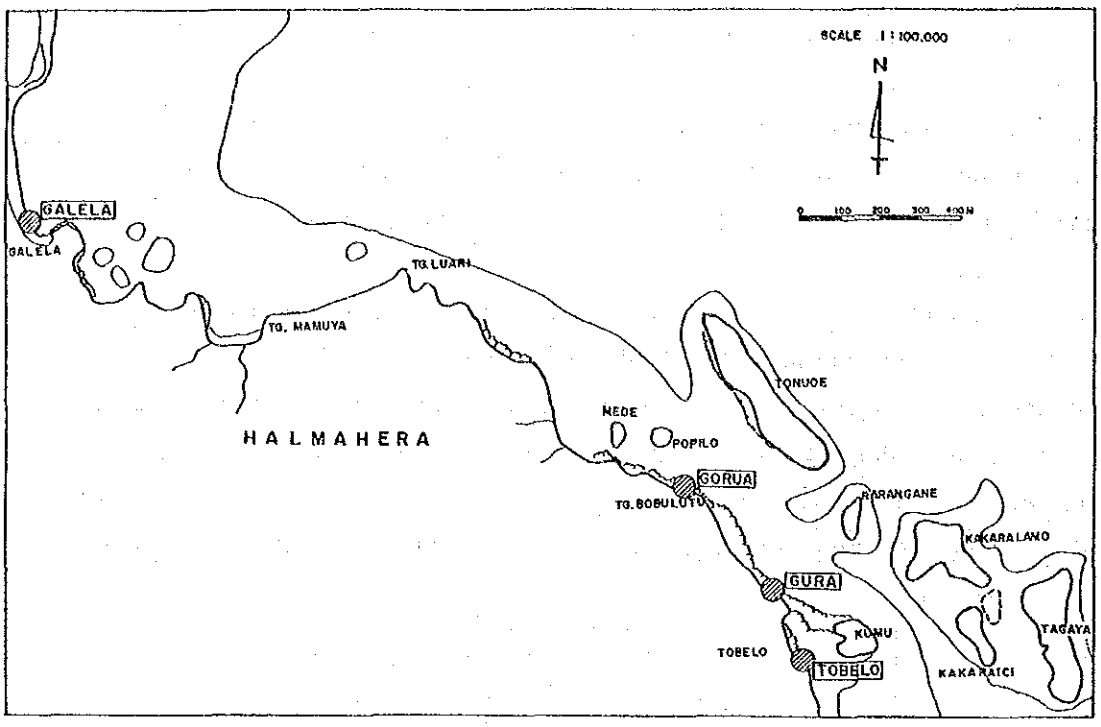


Fig. 2-7 Terminal Site Alternatives in Halmahera Isl.

2-7 South Sumatra-Bangka-Belitung Route

20. As Kayu Arang terminal in South Sumatra-Bangka route has the defect as mentioned in Chapter 2 of Part I, the west coast of Muntok sea port was selected, which is free from the influence of tide and littoral drift from which Kayu Arang terminal now suffers.

21. In the east coast of Bangka Island in Bangka-Belitung Route, three candidate ferry terminal sites were evaluated. Ketapang, next to Pangkal Pinang which is the center of Bangka Island, is located in the middle reaches of a river. It is free from the influence of waves, but it is difficult to obtain sufficient area for terminal. Sadai, located on the southeast coast of Bangka Island, is most appropriate from the view point of oceanographic condition(protection against waves) and land acquisition. The road pavement condition from Pangkal Pinang is partially bad, but an urgent repair plan has been drafted. The new ferry service from Sadai should contribute to the regional development. Sadai was selected for the Bangka Island side terminal site in this ferry route.(See Fig. 2-8)

22. On the west coast of Belitung Island, four candidate terminal sites were evaluated. Tanjung Balong, located to the south of Tanjung Pandan was selected from the synthetic evaluation on accessibility, land acquisition and oceanographic condition(protection against waves).(See Fig. 2-8)

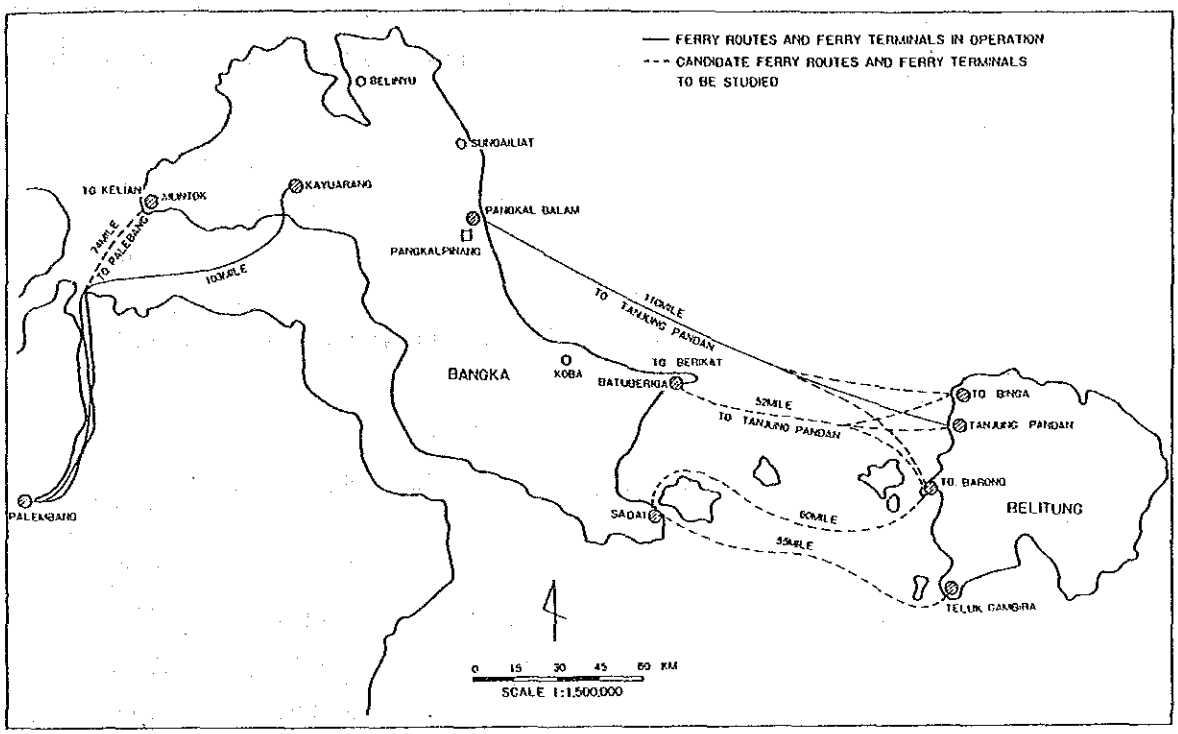


Fig. 2-8 Ferry network of Route-9

Chapter 3 Forecast of Ferry Transportation Demand

3-1 Future Socioeconomic Framework

1. To prepare the Master Plan up to the year of 2010 and Short-Term Plan of 1998 of the Nationwide Ferry Service Routes in Indonesia, a demand forecast is carried out to project the traffic volume of passengers, cargoes and vehicles in the respective target year.

3-1-1 Population

2. The adopted population growth rate of each province is as follows;

Province	1990-1995	1996-2000	2001-2005	2006-2010
Maluku	2.45%	2.13%	1.77%	1.54%
East Nusa Tenggara	2.10%	1.83%	1.52%	1.32%
South Sumatra	2.70%	2.35%	1.95%	1.70%
Irian Jaya	2.97%	2.97%	2.58%	2.14%
Southeast Sulawesi	3.08%	3.08%	2.68%	2.33%

3. The future population in 1998 and 2010 can be calculated based on the adopted growth rates.

Province	1990	1998	2010	2010 /1990	Growth Rate 1980-1990
Maluku	1,858	2,234	2,746	1.48	2.78%
East Nusa Tenggara	3,269	3,830	4,573	1.40	1.79%
South Sumatra	6,277	7,689	9,651	1.54	3.09%
Irian Jaya	1,641	2,074	2,777	1.69	3.41%
Southeast Sulawesi	1,350	1,721	2,342	1.73	3.66%

3-1-2 Gross Regional Domestic Product(GRDP)

4. The future GRDP in 2010 can be calculated based on the growth rates of GRDP in REPELITA V.

Province	1988	2010	2010 /1988	REPELITA V
Maluku	734	2,874	3.91	6.40%
East Nusa Tenggara	632	2,526	4.00	6.50%
South Sumatra	4,330	12,666	2.93	5.00%
Irian Jaya	923	3,689	4.00	6.50%
Southeast Sulawesi	421	1,718	4.08	6.60%

3-2 Methodology of Demand Forecast

3-2-1 Elasticity

5. Generally the growth of passenger and cargo demand isn't in proportion to that of GRDP. We calculate elasticity, which is the growth rate of passenger and cargo per that of GRDP, based on existing data in various transportation systems.

(1) Passenger

6.

All Ferry Routes(1984-1990)	2.0
All Transportation Means(1986-1990) (Ferry, Conventional ships, Railway and Air)	1.2
Bajoe-Kolaka route(1979-1990)	1.2
Railway(Jawa)(1986-1990)	0.8

In this study, 1.1 will be utilized as the elasticity.

(2) Cargo

7.

All Ferry Routes(1984-1990)	3.0
All Transportation Means(1986-1990) (Ferry, Conventional ships, Railway and Air)	0.6

Bajoe-Kolaka route(1979-1990)	0.7
Railway(Jawa)(1986-1990)	1.5

In this study, 1.5 will be utilized as the elasticity.

3-2-2 Passenger

(1) Existing Routes

8. Concerning the existing routes, the future passenger demand can be calculated using the past data. The past data accurately reflects the general characteristics and the trend of social/economic activities in the related hinterlands.

(2) New Routes

9. We divide the existing routes into two groups depending on the length of the routes. One is with the day trip distance of less than 50 miles, the other more than 50 miles. In this study, we predict future passenger traffic on the new routes by adopting the following formula separately to each group.

$$T_{ij} = k * P_i^a * P_j^b * E$$

T_{ij} : Passengers between i-zone and j-zone
P_i : Population of i-zone(small)
P_j : Population of j-zone(large)
E,k,a,b : Parameter

$$E = (1 + G * E_l)$$

G : Growth rate of GRDP per capita
E_l : Elasticity

10. The parameters are decided by recurrent analysis of the exsting routes in each group.

11. The applied process for forecasting the passenger traffic demand is shown in Fig. 3-1.

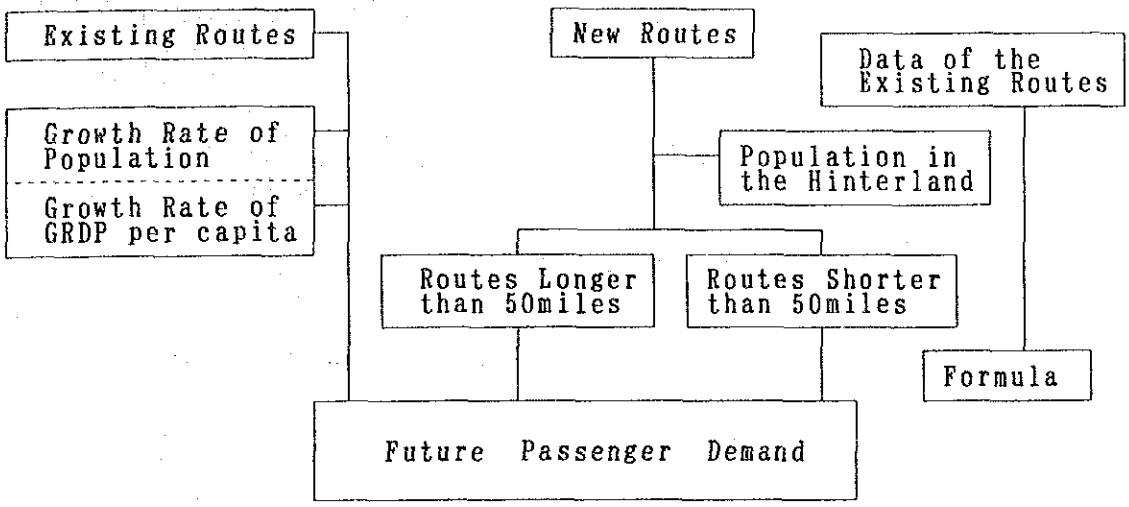


Fig. 3-1 Flow Chart of Passenger Demand Forecast

3-2-3 Cargo

12. Based on data on the existing routes, we calculate the basic unit value to indicate the average cargo demand level in the related region by dividing the cargo volume transported by ferry boats by the population in the hinterland. The result of the calculation shows that the basic unit value for the routes longer than 50 miles is about 0.01 and about 0.03 for the routes shorter than 50 miles.

13. Concerning Bajoe-Kolaka route (Route No.8), the basic unit value on this route based on the past data is about 0.6.

14. Concerning Palembang-Bangka route (Route No.9-1, 74 miles), this route is classified as a "Regional Trunk Route" and has very big potential with Palembang as its hinterland. Therefore, we apply the basic unit value of routes shorter than 50 miles(0.03) on this route.

15. The applied process for forecasting the cargo demand is shown in Fig. 3-2.

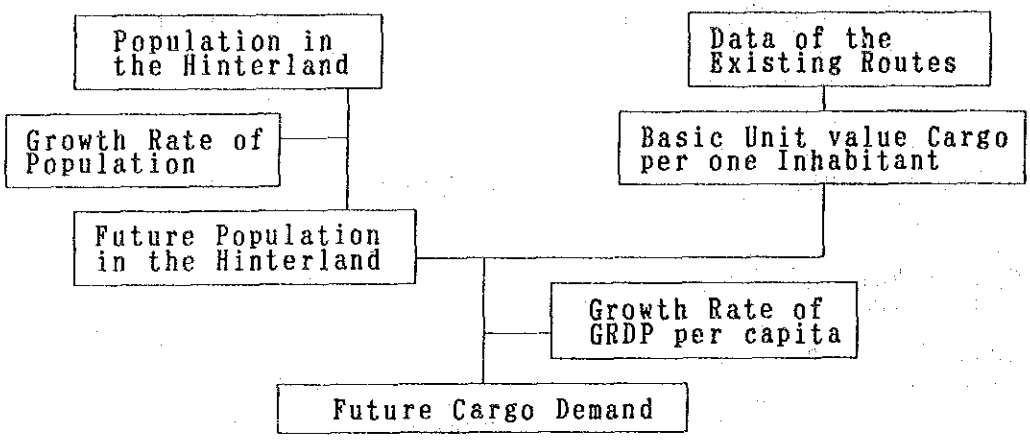


Fig. 3-2 Flow Chart of Cargo Demand Forecast

3-2-4 Vehicle

16. The Study Team assumes that cargoes are transported by 2-ton or 4-ton trucks and load factor is 70% , which results in an average load per truck of 2.1 tons.
On Bajoe-Kolaka route, the average load per truck is assumed 75% for an 8-ton truck, that is 6.0 tons, on this route.

17. All vehicles except trucks are forecasted based on past data. We calculate the basic unit value by dividing the number of passenger cars by that of passengers. It indicates that 25 passenger cars per 1,000 passenger are transported in a year. Taking growth rate of passenger cars per capita into consideration, we forecast vehicle volume.

18. The applied process for forecasting the traffic of vehicles is shown in Fig. 3-3.

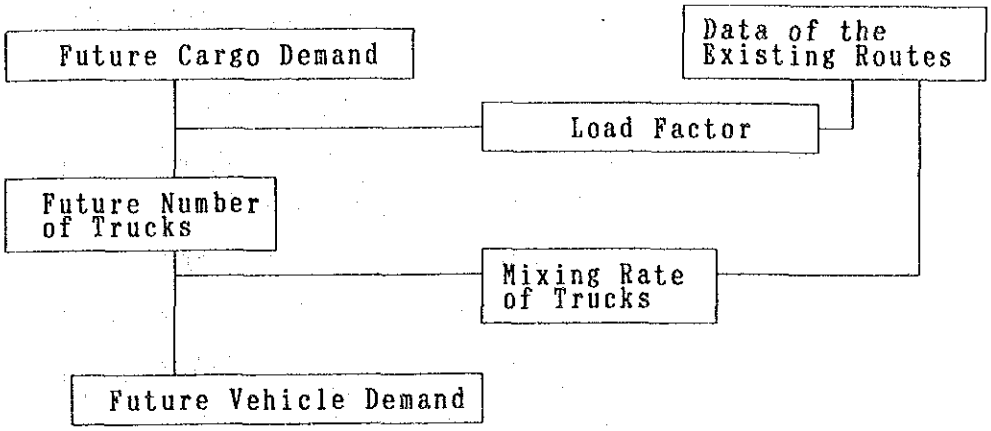


Fig. 3-3 Flow Chart of Vehicle Demand Forecast

19. Concerning two-wheeled-vehicles, we conduct a forecast based on passenger volume. Based on data of the existing routes, we calculate the basic unit value to show the number of 2-wheeled-vehicles per 1,000 passengers by dividing the number of 2-wheeled-vehicles by the number of passengers. The result of the calculation shows that the basic unit value for the routes longer than 50 miles is about 40 and about 15 two-wheeled-vehicles per 1,000 passengers for the routes shorter than 50 miles.

3-3 Forecast of Ferry Transportation Demand

3-3-1 Population in the Hinterland of Each Route

20. Population in the hinterland of each route to be used for forecasting future demand is shown in Table 3-1.

Table 3-1 Population of the Hinterland in Each Route (1990)

	Route	Population	Pi	Population	Pj
1	Hunimua-Waipirit	254,275	Seram Is.(Part)	367,790	Ambon Is.
2-1	Mokumer-Sabuaena	50,766	Yapen Is.	75,343	Biak Is.
2-2	Kabuaena-Kimi	38,411	Kec.Nabire	50,766	Yapen Is.
3-1	Larantuka-Terong	33,562	Larantuka	83,439	Adonara Is.
3-2	Larantuka-Lewoleba	33,562	Larantuka	84,875	Lomblen Is.
3-3	Larantuka-Kalabahi	33,562	Larantuka	110,585	Alor Is.
3-4	Baranusa-Kalabahi	34,035	Pantar Is.	110,585	Alor Is.
4	Kabaena-Bambaea	12,325	Kec.Kabaena	63,159	3 Kec.
5	Kabaena-Mawasangka	14,126	Kec.Kabaena Timur	26,955	Kec.Mawasangka
6	Kendari-Wawonii	21,051	Wawonii Is.	488,392	Kab.Kendari
7	Morotai-Halmahera	44,328	Morotai Is.	62,943	Tobelo+Galela
8	Bajoe-Kolaka	728,074	Kendari+Kolaka	1,523,198	Bone + Kod.Ujungpandang
9-1	Palembang-Bangka	445,351	Bangka Is.(Part)	1,144,279	Kod.Palembang
9-2	Sedai-Tanjung Baron	188,996	Belitung Is.	357,324	Bangka Is.(Part)

3-3-2 Demand Forecast

21. Demand forecast calculated by the method above mentioned is shown in Table 3-2.

Table 3-2 Result of Demand Forecast

No.	Passenger		Cargo	Truck	Sedan	Total	V-2
	1990	2010	2010	2010	2010	2010	2010
1	300,141	1,110,000	33,000	16,000	41,000	57,000	64,000
2-1		154,000	7,000	3,300	5,200	8,500	8,300
2-2		17,000	1,800	800	600	1,400	350
2-3		18,000	1,800	800	600	1,400	400
3-1'		135,000	9,000	4,300	5,400	9,700	6,500
3-2'		135,000	8,000	3,800	5,400	9,200	6,500
3-3'		46,000	1,600	800	1,900	2,700	1,100
3-4'		85,000	5,000	2,400	3,400	5,800	5,400
4		24,000	1,700	800	800	1,600	1,300
5		29,000	2,000	1,000	1,000	1,900	1,500
6		50,000	3,000	1,400	1,600	3,000	2,600
7		120,000	6,000	2,900	4,400	7,300	7,000
8	304,738	1,110,000	206,000	34,000	37,000	71,000	22,000
9-1	81,119	319,000	40,000	19,000	11,000	30,000	18,000
9-2	28,068	70,000	5,600	2,700	2,500	5,200	1,500

Note : Sedan : All 4-wheeled vehicle except truck(Sedan, Mini-bus, Je
V-2 : 2-wheeled vehicle

1 Hunimua - waipirit
2-1 Mokmer - Sabuaena
2-2 Kabuaena - kimi
2-3' Mokumer - Kimi
3-1' Larantuka - Terong
3-2' Larantuka - Lewoleba
3-3' Larantuka - Kalabahi
3-4' Baranusa - Kalabahi
4 Kabaena - Bambaea
5 Kabaena - Mawasangka
6 Kendari - Wawonii
7 Morotai - Halmahera
8 Bajoe - Kolaka
9-1 Palembang - Muntok
9-2 Sedai - Tanjung Barong

Chapter 4 Planning of Ferry Operation

1. As an introduction to planning of ferry operation, the report shall begin by first identifying the weather/sea conditions in the entire Indonesian sea area. The concerning collective study which described in THE FINAL REPORT is mainly based upon the authority of THE INDONESIA PILOT published by THE HYDROGRAPHER OF THE NAVY, UNITED KINGDOM.

2. The following headings are summed up from THE FINAL REPORT relevant to the subject.

4-1 Weather/Sea Conditions

4-1-1 The Eastern Sea Area Relevant to the Route 1,2 and 7

(1) Currents
Molucca Sea, Eastward of Halmahera, Northward of Irian Jaya, Ceram Sea, Banda Sea
(2) Tides and Tidal Streams
(3) Sea and Swell
(4) Climate and Weather
General meteorological and climatic conditions, Pressure, Winds and gales, Front, Depressions and tropical storms, Visibility and fog
(5) Local Weather and Climate
Tobelo(1°-45'N, 128°-02'E), Halmahera and Morotai(2°-15'N,127°- 10'S), Buru and Ceram(3°-15'S,129°-15'E)--south coasts, Ambon(3°- 40'S,128°-10'E), Biak, Irian Jaya -- north coast
(6) Local Current and Tidal Streams
Tidal streams in Teluk Piru(3°-20'S,128°-10'E), Selat Haruku, Selat Ceram, Halmahera Sea, Sorido Lagoon, SE of Biak, Selat Kurudu, Around Biak, Sorenarwa

4-1-2 The Central Sea Area Relevant to the Route 3,4,5,6 and 8

(1) Currents
Currents in Java Sea and Flores Sea, Currents in Banda Sea

(2) Tides and Tidal Streams

(3) Climate and Weather

General remarks, Tropical revolving storms, Fronts, Winds, Gales, Fog and visibility, Sea and swell,

(4) Local Weather, Currents and Tidal Streams

Tidal streams in Selat Larantuka, Tidal streams in Selat Solor, Tidal streams in Selat Lamakera and Selat Boling, Tidal streams in Selat Alor, Tidal streams in Donggala roadstead, Tidal streams in Selat Muna, Winds in Selat Tiworo, Tidal streams in Selat Wowoni, Tidal streams in Teluk Bone, Tidal streams in Teluk Mekongga.

4-1-3 The Western Sea Area Relevant to the Route 9

(1) Currents

Current directions, Current rates

(2) Tides and Tidal Streams

(3) Climate and Weather

General, Pressure and depressions, Tropical revolving storms, Fronts, Winds, Gales, Local coastal winds, Fog and visibility, Sea and swell

(4) Local Weather, Currents and Tidal Streams

Local weather features in Selat Bangka, Currents and tidal streams in Selat Bangka, Tidal streams in Air Musi, Local weather feature in Selat Gelasa, Currents and tidal streams in Selat Gelasa, Currents and tidal streams in NE side of Pulau Bangka, Tidal streams in Pangkalbalam, Current and tidal streams around Pulau Belitung

4-2 Setting up the Model Type of Ferryboat

(1) The Existing Ferry Fleet

3. According to the report by DIREKTORAT BINA SISTEM PRASARANA, the existing ferry fleet in 1990 has attained 73 vessels, totaling those of Perum ASDP and private companies. In addition to this, 21 Ro-Ro ferryboats are under construction at domestic ship yards and are expected to enter service in various routes by the first half of 1992.

4. Classified tables of these 94 ferryboats by type and by age are as follows:

Table 4-1 A Classified Table of Ferryboats by Type

GRT from	to	No.	%
100 and below		12	13
101	200	24	26
201	400	22	23
401	500	16	17
501	1000	11	12
1000 and over		9	9

Table 4-2 A Classified Table of Ferryboats by Age

Year Built from	to	Age	No.	%
1965 and before		27 and over	4	4
1969	1972	23 to 20	10	11
1973	1977	19 to 15	14	15
1978	1982	14 to 10	24	26
1983	1987	9 to 5	18	19
1988	1992	4 and below	24	25

(2) Advantage of Setting up the Model Type of Ferryboat

5. By 2010, the year of completion of the master plan, the implementation body will have to provide more than 20 new ferryboats to put into newly developed/promoted routes. Furthermore, as Table4-2 shows, a certain number of overage vessels should be replaced by new ones year by year to maintain safe and up-dated operation.

6. From the viewpoints of economic procurement of ferryboats, ease of their maintenance, economic supply of spare parts, interchangeability of ferryboats

during the period of their docking/repairing, handy maneuverability of ferryboats, at any rate convenient husbanding, thus, setting up the model type of ferryboat is recommendable for large operators/owners of ferryboats.

(3) The Five Model Types of Ferryboat in the Proposed Routes

7. The model type of ferryboat should be selected taking into account of the natural conditions and traffic demand of the route in which the ferryboat is scheduled for service.

8. According to the study of natural conditions in the Indonesian Sea Area described in chapter 4-1, and the traffic demand estimated in chapter 3, the study team has set up the five optimum types of ferryboat for the nine routes.

9. Based on the aforementioned principle, the five types of ferryboat are derived from **Ship List of 1990** provided by DIREKTORAT BINA SYSTEM PRASARANA and **Ship List Under Construction** provided by DGLT as well, considering that a similar type of ferryboat is applicable enough in a new route of similar conditions. And, as far as the ferry operation is concerned, the fact that no serious sea accidents have been reported so far would support this selection..

10. Table4-3 shows the five optimum types of ferryboat(A,B,C,C' and D)with their principle dimensions and characteristics such as GRT(gross register tonnage), LOA(length over all), B(breadth molded), FD(draft in full load), SPD(speed in knot), and CAPACITY-P (maximum no. of passengers) and C(maximum no. of cars).

11. In this table, we have set a special type of C', whose dimensions are almost same as C type but capable of making 14 knots in service speed, three knots faster than C type. The C' type would be effective and indispensable in medium distance routes, where a ferryboat has to shuttle two round trips every day within daylight hours, or has to complete the trip before sun set where the waterways have some navigational difficulties such as scattering shoals, sunken rocks, strong tidal streams, narrow and sharp bends and also lack of sufficient navigational aids.

Table 4-3 Five Optimum Types of Ferryboat

Type	GRT	LOA(m)	B(m)	FD(m)	Sp'd(kt)	Passengers	Cars
A	1,000	70.0	14.0	3.50	16	600	27
B	500	47.0	11.5	2.60	14	500	15
C	300	38.5	10.5	2.20	11	300	11
C'	300	42.0	10.0	2.40	14	300	11
D	150	30.0	8.0	1.50	11	100	7

4-3 Allocation of Optimum Types of Vessel in Proposed Routes

(1) Criteria for the Allocation

12. In connection with allocation of the optimum type of ferryboat two fundamental criteria are adopted : the natural conditions and traffic demand of the route.

13. As for the natural conditions (see chapter 4-1), we have precisely examined the local weather and sea conditions on each route, particularly regarding maximum tidal drifts and probable maximum wind velocity in and around the sea area. Table4-4 shows the optimum type of vessel for each route which ensure her seaworthiness throughout the service under the given natural conditions.

14. Based on the traffic demand, which has been estimated in chapter 3, the allocation of various types of ferryboat is shown in another column of Table 4-4 independently from that of the natural conditions.

(2) Allocation of the Optimum Type of Ferryboat

15. From the above mentioned two factors, the conclusion has been derived to allocate a larger type of ferryboat as far as it is practical. Table4-4 shows the summary of captioned matter with remarks relevant to the local natural characteristics.

Table 4-4 Allocation of the Optimum Type of Ferryboat (1/2)

ROUTE NO. from to	SEA AREA	DIST. mile	TRIP TIME h m	TIDAL RANGE m cm	MAX. DRIFT knot	BASIN DEPTH m	MAX. WIND force	- - TYPE OF VESSEL - - by NATURAL COND'N	by TRAFFIC DEMAND	CONCLUSION
1 ANBON - SERAM (HUNIMUA)-(WAIPIRIT)	INLAND SEA (TK. PIRU)	11	0-55	2-20		?	6	D	B	B
2 - 1 BIAK - YAPEN-S (MOKMER) (KABUAENA)	OPEN SEA (ST. SORENARWA)	113	08-20	2-20(BIAK)3 2-80(YAPEN)-		?	6	C'	C	C'
YAPEN-S - IRIANJAYA (KABUAENA) (KIMI)	OPEN SEA (TK. IRIAN)	93	9-00	2-50(KIMI)3		?	6	C	C	C
2 - 2 BIAK - YAPEN-N (MOKMER) (SAUBEBA)	OPEN SEA (ST. SORENARWA)	31	02-30	2-20 3 (BIAK)		?	6	C'	C	C'
YAPEN-S - IRIANJAYA (KABUAENA) (KIMI)	OPEN SEA (TK. IRIAN)	93	9-00	2-50 3 (KIMI)		?	6	C	C	C
3 - 1 FLORES - ALOR (LARANTUKA) (KALABAHI)	OPEN SEA (FLORES SEA)	128	13-10	2-20 9 (LARANTUKA)		?	6	B	C	B
3 - 2 FLORES-ADONARA-LOMBLEN-PANTAR-ALOR	OPEN/INLAND SEA									
(LARANTUKA) (TERONG)	(ST. SOLOR)	14	1-10	2-20(L) 1		?	6	B	C	B
(TERONG)-(LEWOLEBA)	(ST. LAMAKERA)	17	1-30	2-75(lewo)7		?	6	-	-	-
(LEWOLEBA)-(BARANUSA)	(ST. BOLANG/FLORES S.)	60	4-30	2-60(BARA)DITTO		?	6	-	-	-
(BARANUSA)-(KALABAHI)	(FLORES S./ST. PANTAR)	37	3-00	2-55(KALA)6		?	6	-	-	-
3-3 (Conpromised Plan of 3-1 & 3-2)			-			?	6	B	C	B

Table 4-4 Allocation of the Optimum Type of Ferryboat (2/2)

ROUTE NO. from to	SEA AREA	DIST. mile	TRIP TIME h m	TIDAL RANGE m cm	MAK. DRIFT knot	BASIN DEPTH m	MAX. WIND force	- - TYPE OF VESSEL - -		
								by NATURAL COND'N	by TRAFFIC DEMAND	CONCLUSION
4 SE. SULAWESI-W. KABAENA (PULEMO) (SIKELI)	OPEN SEA (ST. KABAENA)	34	3-30	2-80 (BAUBAU)	-	?	6	C	C	C
5 E. KABAENA - W. MUNA (DONGGALA) (MAWASANGKA)	INLAND SEA (ST. MUNA)	14	1-30	-DO-	-	?	8	D	D	D
6 KENDARI - WOWONI (LANGGALA)	INLAND SEA (ST. WOWONI)	26	2-30	-DO-	3	?	6	D	D	D
7 MOROTAI - KALAMAKERA (TOBELO) (GORUA)	OPEN SEA (HALMAHERA)	25	2-30	2-10 (GORUA)	SLIGHT	?	6	C	C	C
8 BAJOE - KOLAKA	OPEN SEA (TK. BONE)	80	5-20	2-40	SLIGHT	?	6	C	A	A
9 PALEMB'G - BANGKA (MUNTOK) BANGKA - BELITUNG (SADAI) (TG. BARONG)	INLAND SEA (ST. BANGKA) OPEN SEA (S. CHINA SEA)	74 70	6-30 5-30	3-80 - (TG. PANDAN)	2 3	? ?	6 6	C C'	A C	B C'

4-4 Planning of Ferry Operation

(1) Loading Capacity of Cars on Each Type of Ferryboat

16. To estimate the number of round trip service to meet the traffic demand of a route, the car loading capacity of each type of ferryboat has been assumed by the following method:

* The effective loading deck space of a ferryboat to accommodate cars(A) is assumed according to the following formula,

  $A = 0.7 \times L \times B$

  L: length overall of the ferryboat

  B: breadth molded of the ferryboat

* The necessary space to accommodate the various sizes of trucks and sedans onto the loading deck are assumed according to the following:

  8 ton truck --- $25m^2$

  4 -do- --- $19m^2$

  2 -do- --- $9.5m^2$

  sedan --- -do-

* From the above account, the car loading capacity of each type of ferryboat is estimated as follows:

Type of f/boat	GRT	L(m)	B(m)	$A(m^2)$	8^t-T	4^t-T	2^t-T
A	1,000	70	14	686	27	36	72
B	500	47	11.5	378	15	20	40
C	300	39	10.5	287	-	15	30
C'	300	39	10	273	-	14	28
D	150	30	8	168	-	9	18

(2) Method for Estimating Required Service Frequency in the Routes

17. Required service frequency in each route is assumed by two factors of the traffic demand of passengers and cargoes:

* Estimating method of daily service frequency for cargoes(N_C) is as follows,

$$N_C = \frac{P}{T \times 365 \times N \times O \times M}$$

P: Volume of cargoes(ton/year)

T: Average cargo volume per one truck(ton) = Maximum loading capacity x **0.7**

N: Net operation ratio of a ferryboat through the year derived from actual record of Bajoe-Kolaka route, excluding suspended service mainly due to docking = **0.9**

O: Average occupancy ratio of loaded cars in one trip = **0.6**

M: Maximum car loading capacity of each type of ferryboat

18. In addition to this, the transport of cars other than trucks should be included by using " mixing ratio" which means the portion of truck in total car carried by ferry.

19. From these accounts, the results of required frequency of service trip for cars are shown in Table4-5.

* Method for estimating daily service frequency for passengers(N_p) is as follows,

$$N_p = \frac{P'}{365 \times N \times O' \times M'}$$

P': Total number of passenger per year

O': Average passenger occupancy ratio in one trip service = **0.6**

M': Maximum embarking capacity of passengers in each type of ferry vessel

(2) A Plan for Ferry Trip Service Schedule in the Nine Proposed Routes

20. A ferry trip service schedule on the nine proposed routes derived from aforementioned paragraphs is shown in Table4-5 on the next page. And, in connection to the Table4-5, a model of "Time Table of Ferry Service " on each route is shown in Fig.4-1 to 4-9.

Table 4-5 A model for Ferry Trip Schedule on the Nine Proposed Routes

No.	Service Route from	to	Dist/Time mile/h-m	Required R.Trip/Day (passenger)	(cargo)	Req'd Type	Vessel No.
1	Hunimura	- Waipirit	11'/00-55	6 (5.6)	4 (3.7)	B	2
2-1	Mokmer	- Saubeba	31'/02-30	2 (1.4)	1 (1.1)	C'	1
2-2	Kabuaena	- Kimi	93'/09-00	$^1/_7$(0.1)	$^1/_7$(0.2)	C	1
3-1	Larantuka	- Terong	14'/01-10	2 (1.6)	2 (1.7)	B	2
3-2	Terong	- Lewoleba	17'/01-20	1 (0.9)	1 (0.9)	B	(2)
3-3	Lewoleba	- Baranusa	60'/04-30	1 (0.4)	1 (0.4)	B	(1)
3-4	Baranusa	- Kalabahi	37'/03-00	1 (0.7)	1 (0.6)	B	(1)
4	Pulemo	- Sikeli	34'/03-30	$^1/_7$(0.2)	$^1/_7$(0.2)	C	1
5	Dongkala	- Mawasangka	14'/01-30	1 (0.5)	1 (0.3)	D	1
6	Kendari	- Wowoni	26'/02-30	1 (0.9)	1 (0.5)	D	1
7	Tobelo	- Doruba	25'/02-30	1 (1.0)	1 (0.8)	C	1
8	Bajoe	- Kolaka	80'/05-20	5 (4.7)	5 (4.5)	A	5
9-1	Palembang	- Muntok	74'/06-30	2 (1.6)	2 (2.2)	B	2
9-2	Tg.Barong	- Sadai	70'/05-30	1 (0.6)	1 (0.6)	C'	1

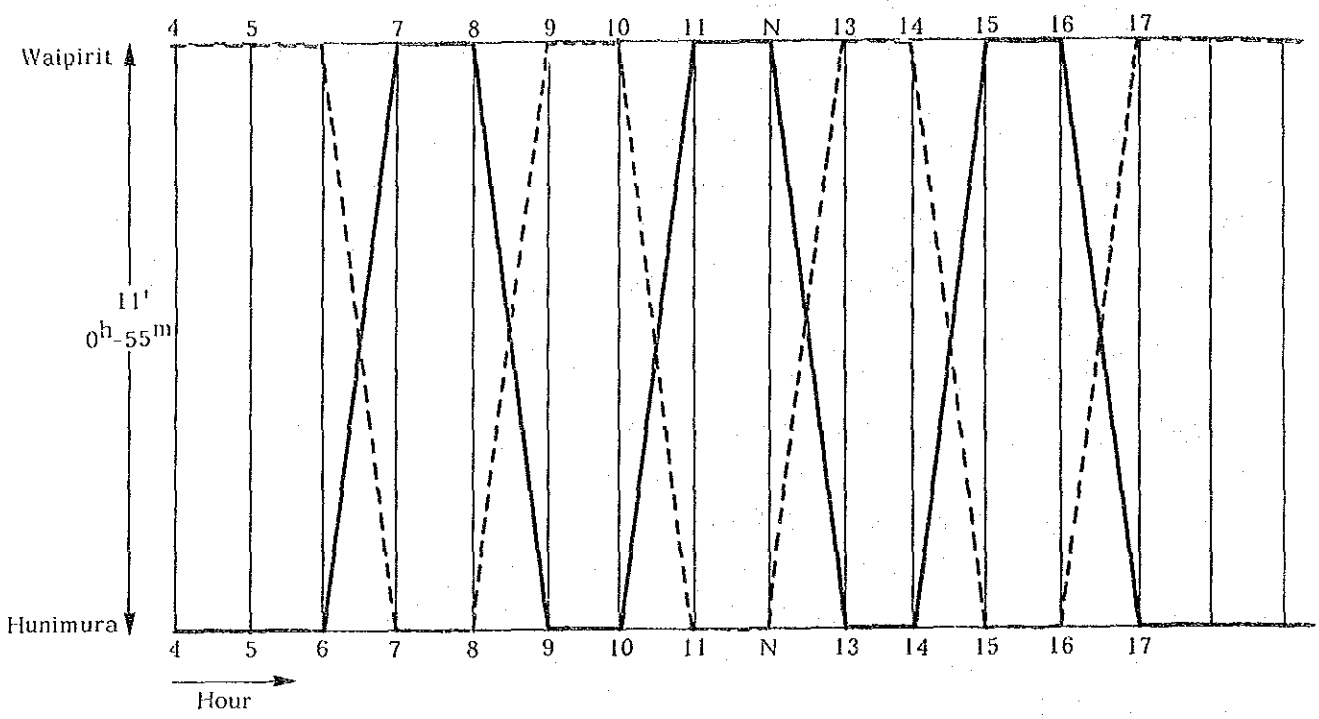


Fig. 4-1 Time Table of Ferry Service

ROUTE 1 Hunimiura - Waipirit

(six round trips/day by two B ferryboats)

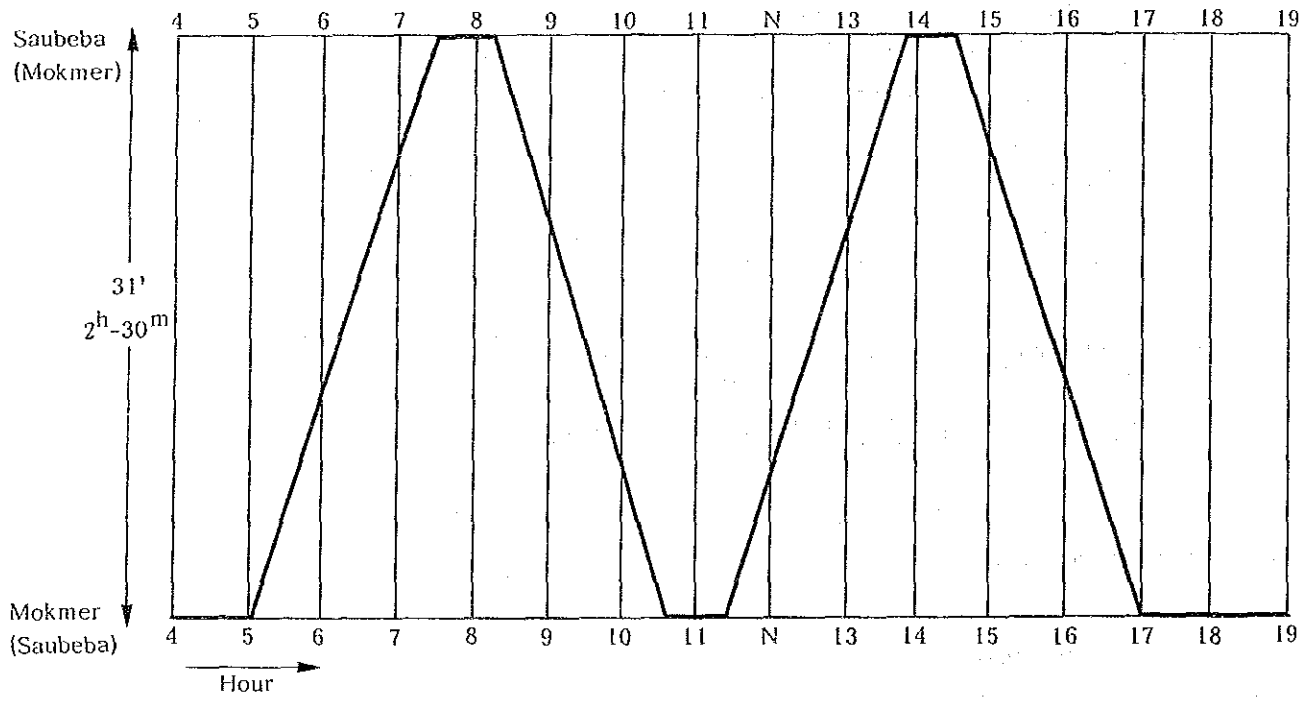


Fig. 4-2(1)

ROUTE 2-1 Saubeba Mokmer

(two round trips/day one c' ferryboats)

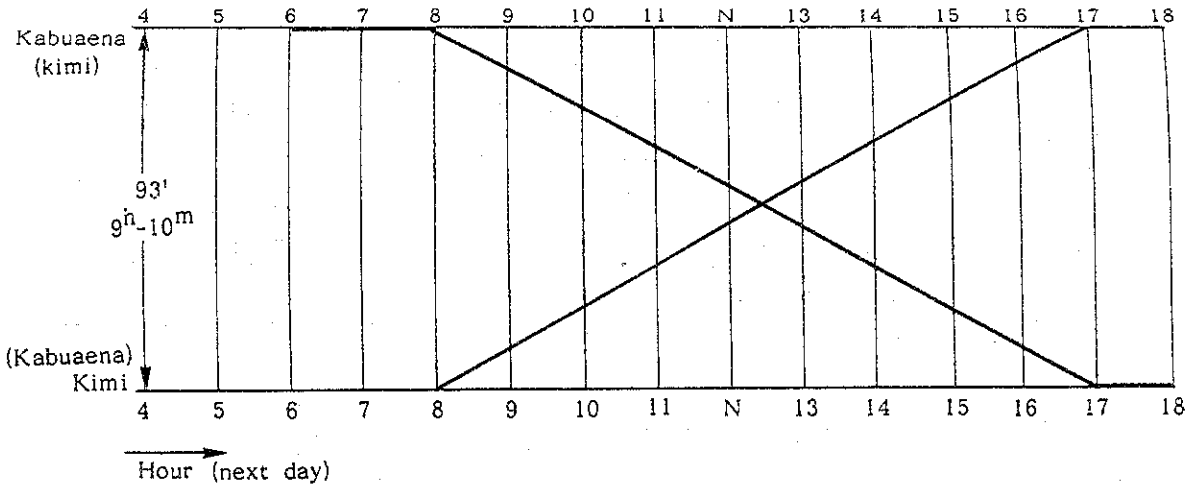


Fig. 4-2(2)

ROUTE 2-2 Kabuaena - Kimi

(one round trip/week one C ferryboat)

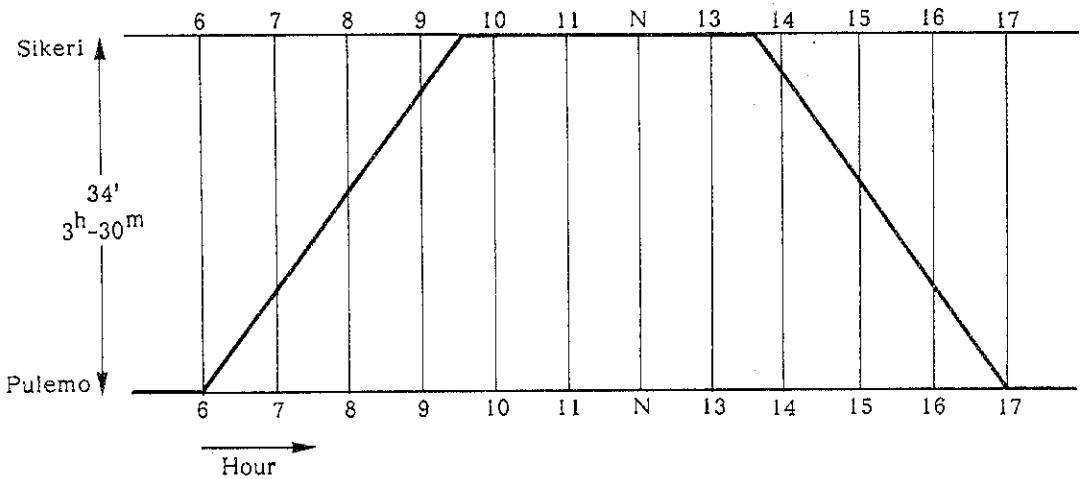


Fig. 4-4

ROUTE 4 Sikeli - Pulemo

(one round trip/week by one C ferryboat)

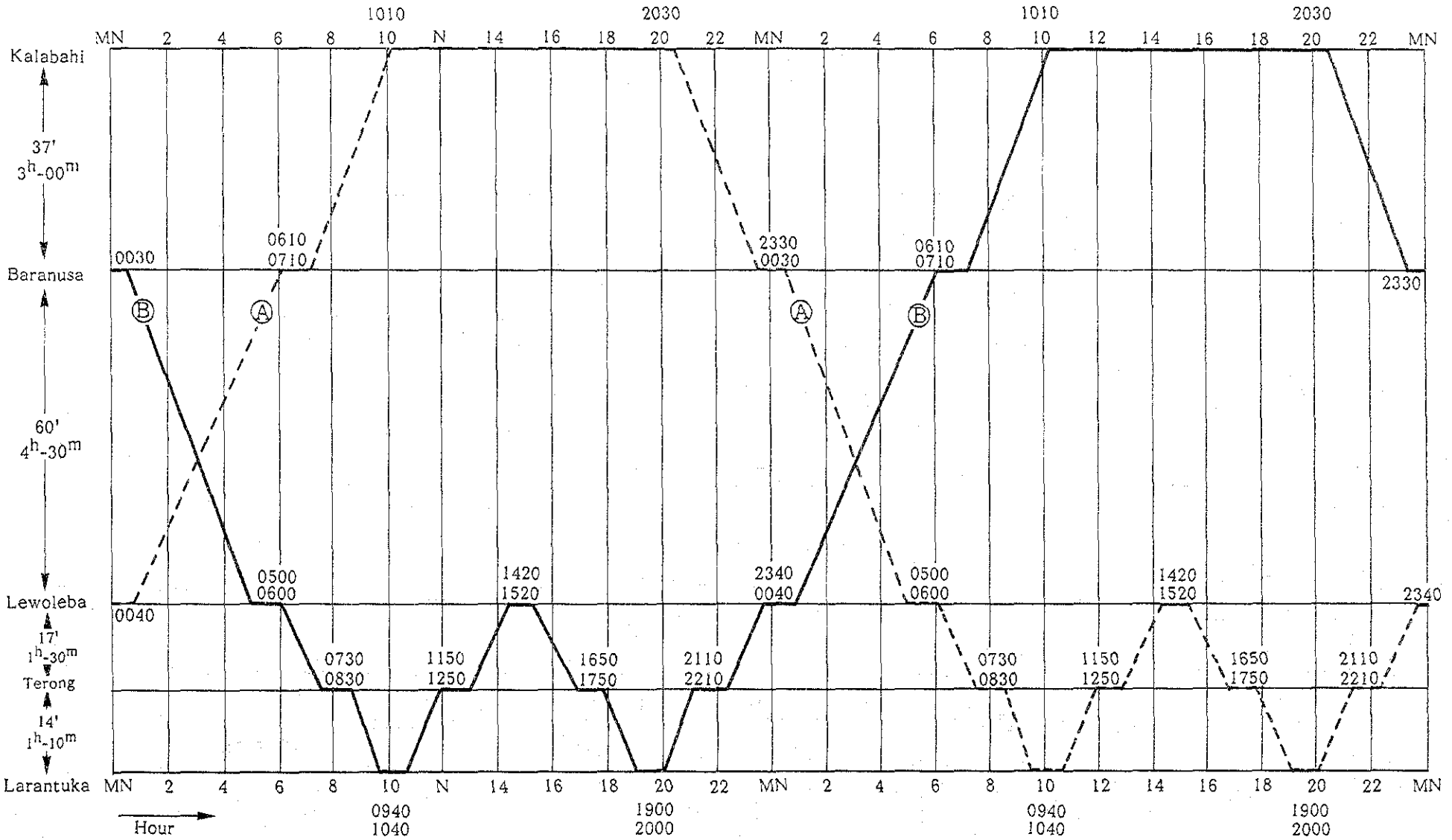


Fig. 4-3

ROUTE 3

Larantuka -Teromng - Lewoleba -Baranusa -Kalabahi

(Larantuka - Lewoleba: two round trip/day

(Lewoleba - Baranusa -Kalabahi: one round trip/day by two B ferryboat)

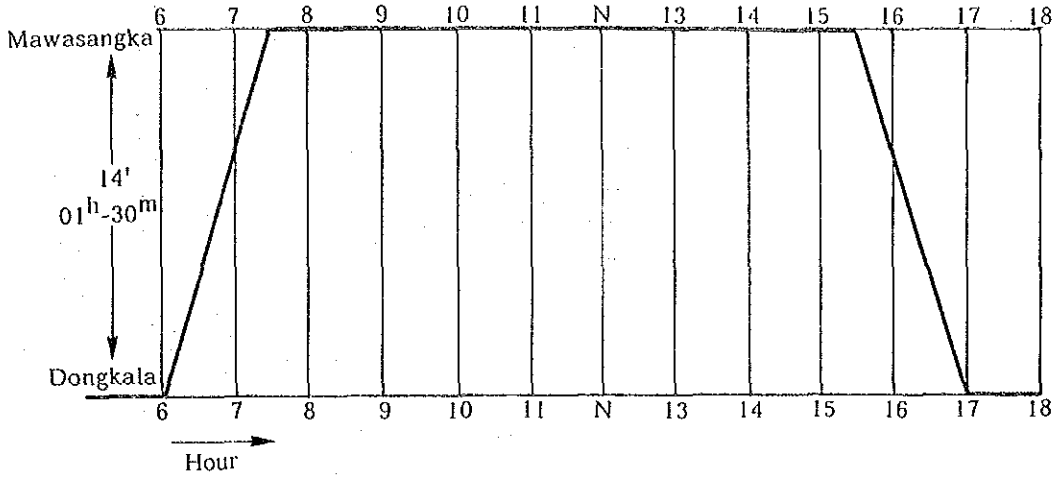


Fig. 4-5
ROUTE 5 Dongkala - Mawasangka
(one round trip/day by one D ferryboat)

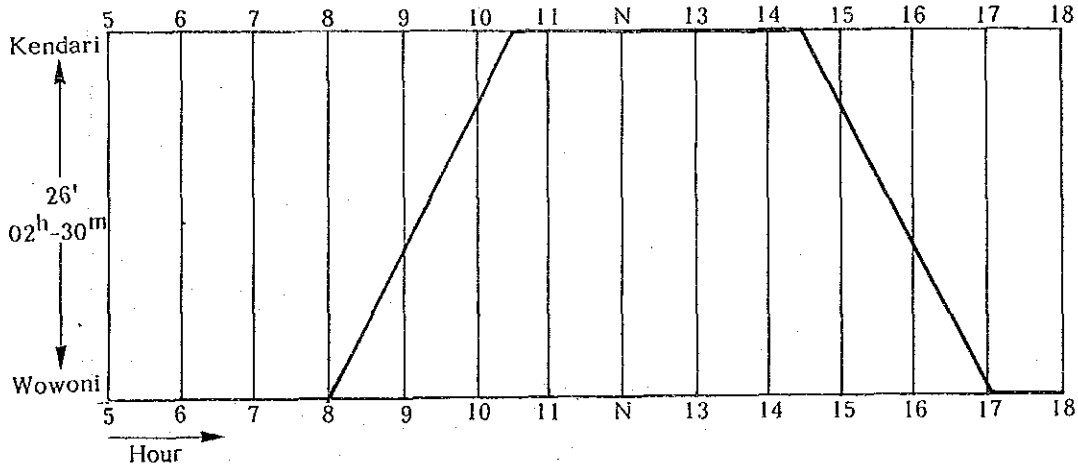


Fig. 4-6
ROUTE 6 Wowoni - Kendari
(one round trip/day by one D ferryboat)

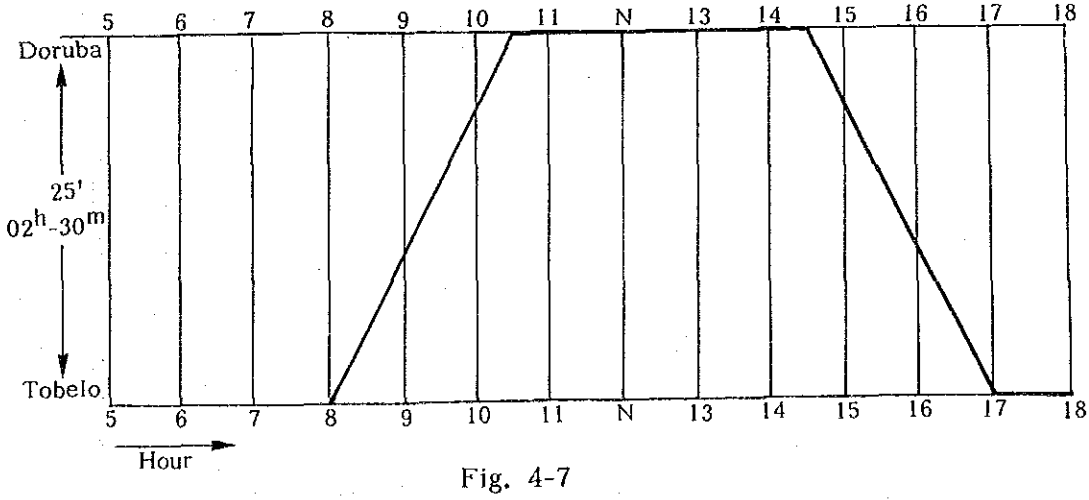


Fig. 4-7
ROUTE 7 Doruba - Tobelo
(one round trip/day by one C ferryboat)

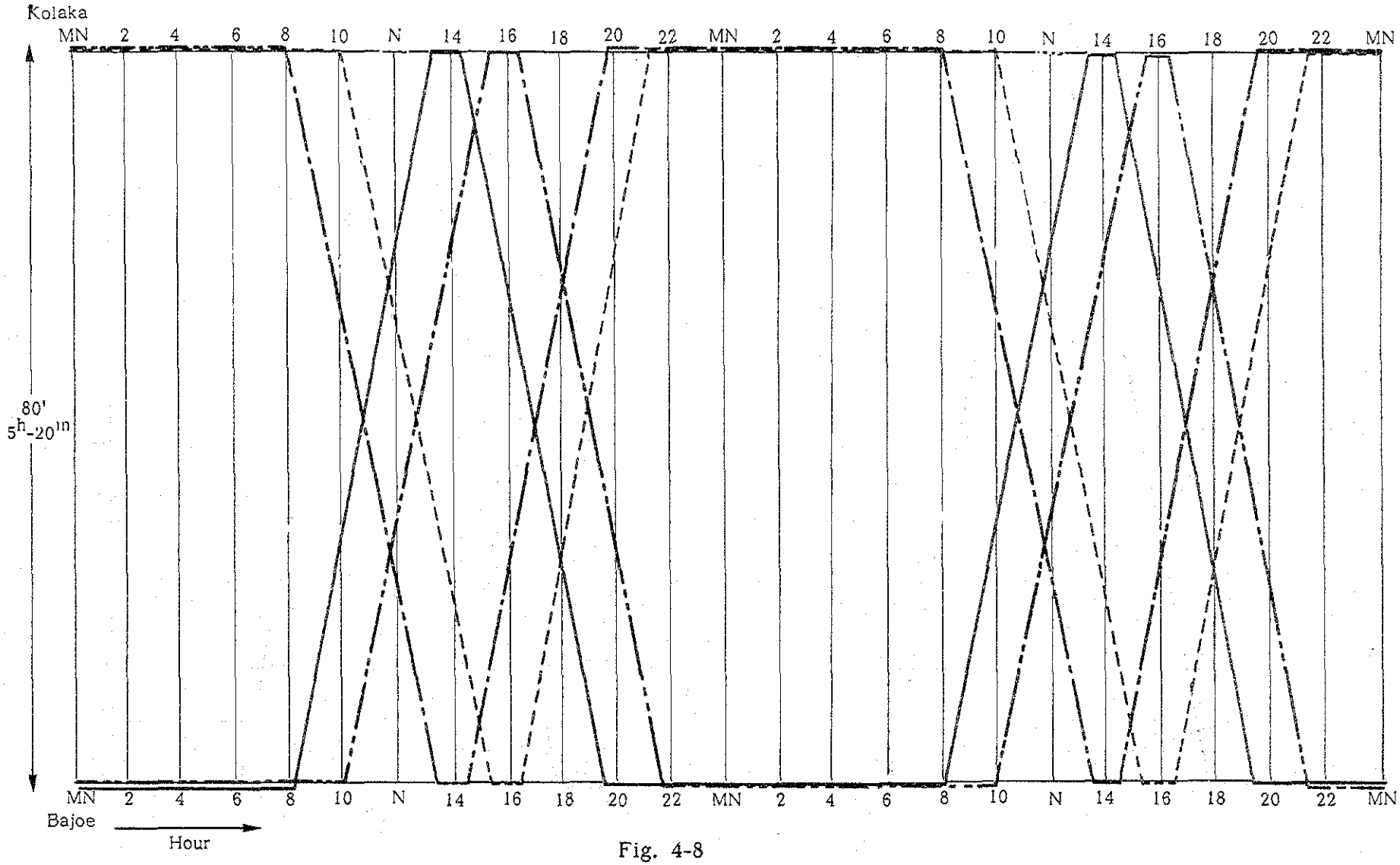


Fig. 4-8
ROUTE 8 Kolaka - Bejoe
(five round trip/day by five A ferryboat)

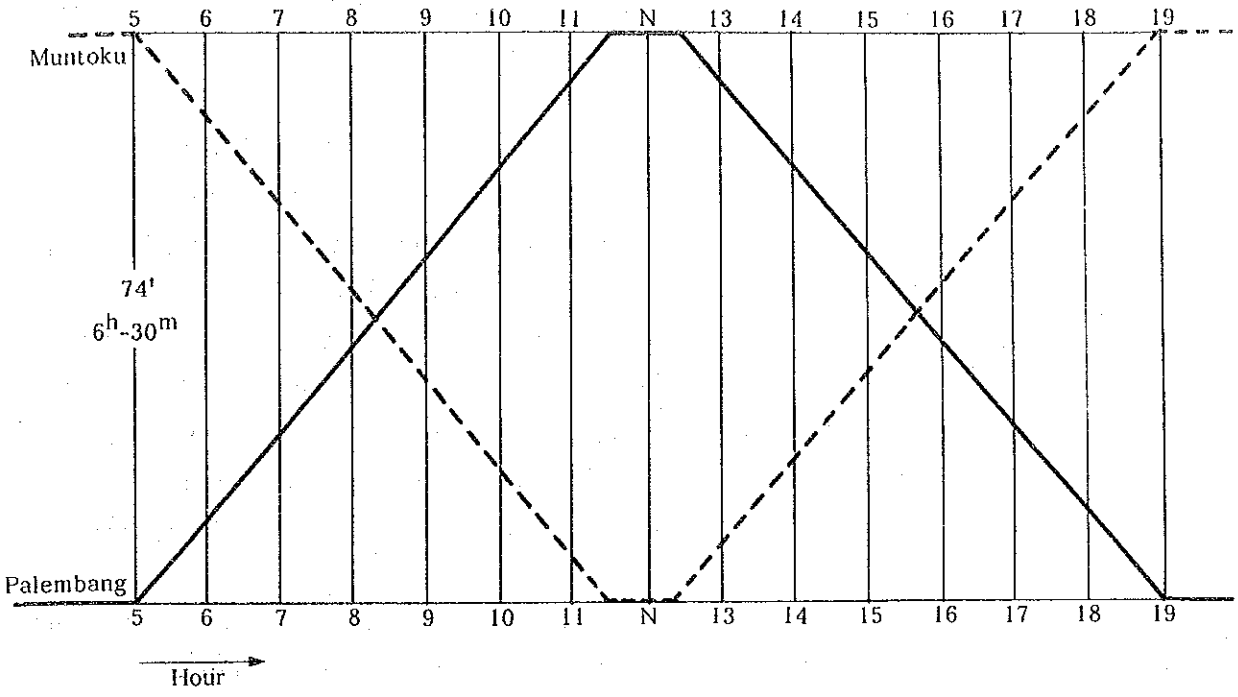


Fig. 4-9(1)
ROUTE 9-1 Palembang - Muntok
(two round trips/day by two B ferryboats)

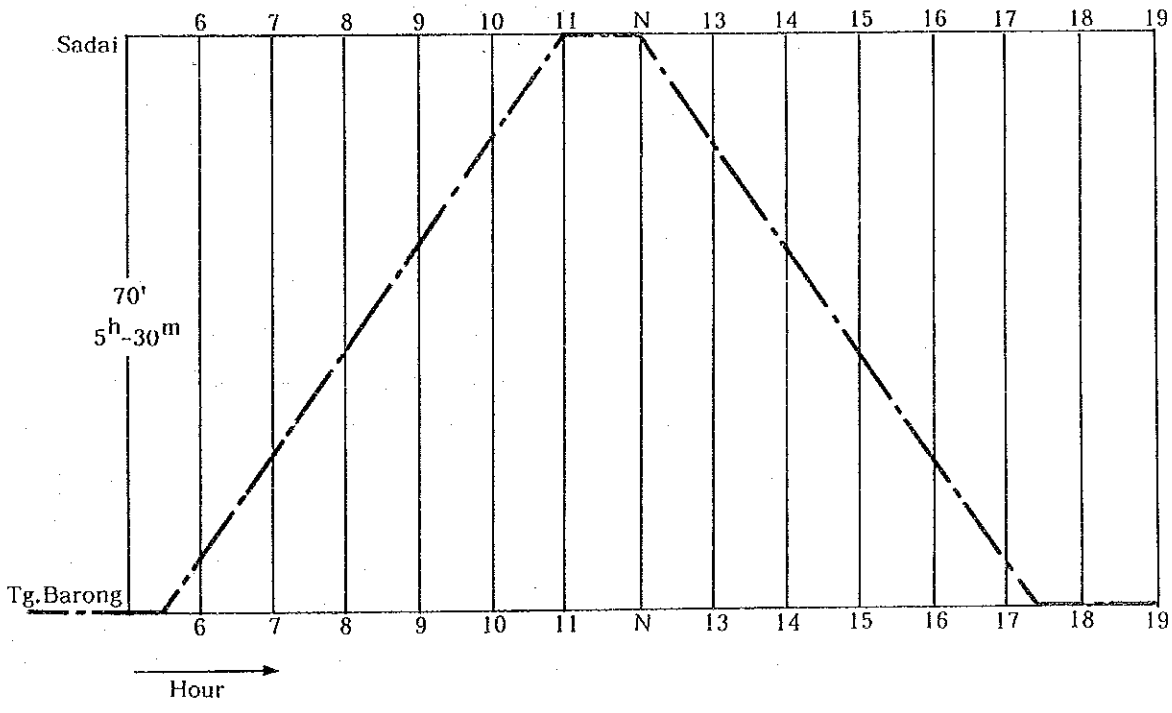


FIg. 4-9(2)
ROUTE 9-2 Tg.Barong - Sadai
(one round trip/day by one C' ferryboat)

Chapter 5 Ferry Terminal Development Plans

5-1 General

1. As mentioned in Chapter 2, 25 terminal sites were selected for the nine study routes by the evaluation of natural conditions,current land use condition and accessibility. Most of the terminals selected seem not to require breakwaters to protect berthing areas from waves although further detailed survey will be necessary at some terminal sites such as Mokmer and Saubeba, Pulemo and Muntok.(Further natural condition survey was conducted at Mokmer, Saubeba and Muntok for Short-Term Plan in Part III.)

2. In principle, the land for the construction of a new terminal will be prepared by readjustment of the natural beach neighboring the planned mooring facilities. However, in the following terminal sites, it will be difficult to construct a terminal on the natural beach or land behind the beach because a number of residences or public facilities occupy the area.

Land for terminal to be prepared by reclamation:

Route 2	Kabuaena
Route 4	Sikeli
Route 5	Dongkala & Mawasangka
Route 6	Kendari & Wowonii
Route 8	Bajoe & Kolaka

3. In Indonesia, there exist three types of rolling-on system of vehicles at mooring facilities, that is , movable bridge type, pontoon type and fixed type. Based on the sea conditions at terminal sites and the recent trend in the transition of rolling-on system at ferry terminals, the movable bridge type will be adopted for design.

5-2 Ferry Terminal Development Plans on Each Route

5-2-1 Ambon - Seram Route

4. The two ferry boats now in operation are about 150 and 200GRT-class.

According to the Master Plan, two 500GRT-class ferry boats should be introduced in 2010.

5. Since the existing rolling-on system is a fixed type, to ensure smooth embarkation/disembarkation of vehicles it will be recommended to introduce a movable bridge type. New mooring facilities and jetty should be constructed a little to the north of the existing mooring facilities in Hunimua(Ambon Island) and to the southwest in Waipirit(Seram Island) to make it possible to provide continuous ferry service using the existing facilities even during the period of the construction of new facilities. The existing facilities can be utilized to cope with the increase of demand of passengers/cargo further in future with the reinforcements.

5-2-2 Biak - Yapen - Irian Jaya Route

6. Although a new terminal site at Mokmer is protected from southeasterly waves by the islands in front of Mokmer, it is necessary to protect the new Mokmer port from southwesterly waves by constructing a breakwater.

7. At a new terminal site at Saubeba, it is necessary to further protect the berthing area against waves by the construction of breakwaters on the shoals existing on the west and east of the planning berthing basin

8. At Kabuaena, the land for terminal facilities should be prepared by readjustment of the fairly flat land in the east of Kabuaena village outside the residential district.

9. The land for terminal facilities should be prepared apart from the residential areas. Two rivers flow into the sea area on the north side and the south side of the terminal site. To keep away the undesirable influence of littoral drift and maintain sufficient water depth around the berthing area, the structural type of the jetty should be designed properly.

5-2-3 Flores - Alor Route

10. The Flores-Alor route connects five islands, Flores, Adonara, Lomblen, Pantar and Alor. According to the demand forecast and oceanographic condition, a 300GRT-class ferry boat will be introduced on the Flores-Adonara-Lomblen route, however when this route is extended to Alor Island, 500GRT-class ferry boats should be introduced because of oceanographic condition. Therefore, mooring facilities for this route should be designed for 500GRT-class ferry boat.

11. The existing rolling-on system at Larantuka is the movable bridge type and the mooring facilities are designed for the berthing of a 500GRT ferry boat. Therefore, introducing 500GRT-class ferry boat on this route does not require any improvements to the existing mooring facilities and rolling-on system at Larantuka.

12. The jetties and mooring facilities of Terong and Baranusa sea ports exist close to the planned sites. Therefore, the sites of the ferry terminal and the approach channel should carefully be selected so as not to have an undesirable influence on the sea port activities.

13. A new terminal plan for ferry service in Kalabahi has been made and the reclamation has already started.

5-2-4 Southeast Sulawesi - West Kabaena Route

14. The terminal site on the main island side of Southeast Sulawesi is selected at Pulemo near Banbaea village because of its favorable sea conditions(protected well by reef against waves) and also a sufficient water depth at inner sea area. However, a detailed topographical survey is necessary to determine the access channel.

15. The terminal site on the west coast of Kabaena Island is selected at Sikeli. A sea port exists next to the planned ferry terminal site; safe sea navigation has been maintained and sea conditions around here are favorable.

5-2-5 East Kabaena - Muna Route

16. The land for Dongkala terminal in Kabaena island is planned to be prepared by reclamation in the sea area to the south of the existing jetty because the sea area in the north of the jetty is now occupied by a lot of beach houses. Mooring facilities are planned at an area around the tip of the existing jetty because of the calmness of waves which can be attributed to the fact that there is an island in front of this area.

17. The mooring facilities in Mawasangka of Muna Island are required to be built at the tip of the extended existing jetty. Detailed surveys should be conducted on sea bottom topography to find a proper access channel to the mooring facilities.

5-2-6 Kendari - Wowonii Route

18. Mooring facilities in Kendari will be constructed at the tip of the extended existing jetty. In an area in the west of the jetty, aquatic plants grow thickly with very shallow water depth and the beach area in the west of the base of the jetty is occupied with several shops. The land for the terminal here could only be prepared by reclamation of the water area to the east of the existing jetty.

19. Mooring facilities in Langgara of Wowonii Island will be installed at the tip of the new jetty constructed at the existing wooden pier. Land for on-land ferry terminal will be constructed on reclaimed land of the south of the new jetty.

5-2-7 Morotai - Halmahera Route

20. Ferry terminal at Gorua(Morotai Island) will be prepared on the land behind the beach apart from the residences. The access road(3-4km to Tobelo) is paved and in good condition.

21. Because of the topographical conditions, terminal facilities at Daruba

(Halmahera) should be constructed on the readjusted high land behind the beach, the ground level of which is about ten meters. There are no residences around here. An existing road is available for access from the center of Daruba.

5-2-8 South Sulawesi - Southeast Sulawesi Route

22. Due to the shallowness and the continuous sedimentation in the planned sea area, the size of ferry boat to be introduced here should be limited. Based on the sea bottom topography on Bajoe side(South Sulawesi), 1000GRT-class ferry boats are planned to be introduced. New mooring facilities in Bajoe and Kolaka(Southeast Sulawesi) should be constructed a little apart from the existing mooring facilities.

23. In Bajoe terminal, the 2.7km-jetty connecting existing on-land facilities with mooring facilities is too long for passengers. When passengers and vehicles are disembarking from ferry, the jetty is congested. Since there is a shoal near the mooring facilities, it is possible to utilize it for the construction of a passenger waiting terminal and parking area.

24. In Kolaka terminal, there is not a parking lot exclusively used for vehicles embarking on a ferry boat, thus a new parking lot is planned to be constructed on the beach area to the west of the existing terminal by reclamation.

5-2-9 South Sumatra - Bangka Route

25. In Palembang(Sumatra main island), a pontoon for 200GRT-class ferry exists.The water depth around here is sufficient to install mooring facilities for 500GRT-class ferry.

26. A new terminal site on Bangka island side is located to the west of Muntok port because of the current bad sea accessibility to Kayu Arang as described in Chapter 2 of Part I.

The distance by road from Muntok to Pankal Pinang is 60km longer than that of Kayu Arang-Pankal Pinang, but Muntok seems to be more appropriate as

a site for the ferry terminal because there is much more convenient bus/truck service on the route of Muntok-Pankal Pinang. The distance on sea to Palembang from Muntok is 55km shorter than that from Kayu Arang.

5-2-10 Bangka - Belitung Route

27. The existing ferry service on this route is provided utilizing the general cargo quay at Pankal Balam port in Bangka island and the wooden pier for passenger ships at Tanjung Pandan port in Belitung island as described in Part I, thus exclusive ferry terminal facilities have been requested. To meet this request, two terminal sites have been selected, at Sadai in Bangka island and at Tanjung Barong in Belitung island.

The proposed sites in Sadai and Tanjung Barong are protected from waves by islands and capes and will be very calm even without breakwaters.

28. Road pavement condition from Pankal Pinang to Sadai is partially bad now, though the improvement of the deteriorated portion of the road has been scheduled already.

Chapter 6 Ferry Terminal Standard Design

6-1 General

1. The ferry terminal can be divided into two facilities from the design point of view,namely, the mooring facility and on-land facility. The capacity of planned ferry boat for each terminal is determined by the demand of passengers and vehicles to be transported or is determined by the maritime condition of the sea lane. If the ferry boat determined by the demand is bigger than that determined by the maritime conditions, the mooring facility and on-land facility of the terminal will be designed for the bigger ferry boat. However, if the ferry boat determined by the maritime condition is bigger, the mooring facility should be designed for the bigger ferry boat, but the on-land facility may be designed for the smaller ferry boat determined by the demand. Only for Route No.3 and No.4,the ferry boat determined by the maritime condition is bigger than that determined by the demand.

6-2 Standard Dimensions of Ferry Boat

2. It has been determined that four(4) types of ferry boats should be introduced to the planned nine(9) routes. The standard dimensions of the ferry boats are have been established considering the dimensions of existing and planned ferry boats in Indonesia as shown below;

Gross Tonnage	LOA	Breadth	Full Loaded Draft	Number of Passengers	Number of Vehicles	
(ton)	(m)	(m)	(m)	(person)	8t-T	4t-T
150	30.0	8.0	1.50	100	-	9
300	39.0	10.5	2.20	300	-	15
500	47.0	11.5	2.60	500	-	20
1,000	70.0	14.0	3.50	600	27	-

6-3 Planned Ferry Boat of Each Terminal

3. The planned ferry boats to be considered for the terminal design are as follows;

Route	Terminal Site	Objective Ferry for Mooring Facility	Objective Ferry for On-land Facilities
1	Hunimua-Waipirit	500 GRT	500 GRT
2-1	Mokmer-Saubeba	300 GRT	300 GRT
2-2	Kabuaena-Kimi	300 GRT	300 GRT
3	Larantoka-Terong-Lewoleba-Baranusa-Kalabahi	500 GRT	300 GRT
4	Pulemo-Sikeli	300 GRT	150 GRT
5	Dongkala-Mawasangka	150 GRT	150 GRT
6	Kendari-Langara	150 GRT	150 GRT
7	Gorua-Daruba	300 GRT	300 GRT
8	Bajoe-Kolaka	1,000 GRT	1,000 GRT
9-1	Palembang-Muntok	500 GRT	500 GRT
9-2	Sadai-Tj.Barong	300 GRT	300 GRT

6-4 Water Depth of Berth

4. The water depth of the berth is determined by the fully loaded draft of the maximum size planned ferry boat and suitable allowance should be made for the movement of the ferry boat by wave action. In this design, 50 cm of allowance for all ferry boats is adopted considering the shallow coastal area of many of the proposed terminal sites.

6-5 Crown Height

5. The crown height of berth should be determined by the tide elevation,

wave condition and loading/unloading condition of vehicles. In general, 0.3 m to 1.0 m or 0.5 m to 1.5 m above HWL is adopted for the crown height when the tidal range is more than 3.0 m or less than 3.0 m respectively. In this design, the following crown heights are recommended;

Tide Range	Crown Height
1.50 m to less than 2.40 m	+3.0 m
2.40 m to less than 2.80 m	+3.5 m
2.80 m to less than 3.20 m	+4.0 m
3.20 m to less than 3.80 m	+4.5 m
3.80 m to less than 4.20 m	+5.0 m

6-6 Breasting Dolphin

6. If only one type of ferry boat is berthed at the mooring facility, two(2) breasting dolphins will be sufficient but it is preferable that many types of ferry boats can be accommodated at a mooring facility except those ferry boats which are larger than the planned ferry boat. For this purpose three(3) breasting dolphins will be provided at each mooring facility.

7. The fender system on the breasting dolphin should be able to absorb the ship's berthing energy which can be calculated based on the berthing method and the arrangement of fenders. In this design, a berthing velocity of 30 cm/sec and an approaching angle of 10 degree are applied as a berthing method.

8. From the economic and coastal engineering points of view, a concrete top with pile foundation is recommended as the structure of breasting dolphins in this design.

6-7 Mooring Dolphin

9. At the end of the berth, mooring dolphins for bow lines and stern lines are provided as these lines can work efficiently against the movement of the ship by wind and current forces for both longitudinal and transversal directions.

Therefore, the mooring dolphins are located at positions from where mooring lines can be taken with an angle of 30 to 45 degrees to the face line of the berth.

10. In addition to the bow and stern lines, the spring lines are used to moor the ship safely especially against a strong wind or current. For these spring lines the mooring posts are installed on the breasting dolphins.

11. The tractive force of mooring posts on the mooring and breasting dolphins of Route No.8 is decided as 25 ton and the mooring posts of other routes are decided as 15 ton of tractive force.

12. The structure of mooring dolphin is a concrete top with pile foundation, same as the breasting dolphin.

6-8 Vehicle Ramp

13. In order to load or unload vehicles, a vehicle ramp should be provided to smoothly connect the ferry boat and mooring facility. The tidal range of all terminal sites are more than 1.5 m.Therefore, the movable type vehicle ramp should be installed, and since a pontoon type requires high maintenance cost, the movable bridge type was recommended.

14. Considering the traffic conditions of the project sites, a maximum gradient of 12 % is applied for the movable bridge ramps of Route No.8 and 17 % is applied for all other routes.

15. The length of movable bridge should be determined considering the tidal range, the length of ship ramp, the elevation of free board, changes of draft by loading conditions, the allowable gradient, wave condition and the crown height of mooring facility. Therefore, the lengths of movable bridges are different at each terminal. The length will be 7.0 m, the shortest at Gorua, and 22.0 m, the longest at Muntok.

6-9 Passenger Terminal Building

16. The passenger terminal building consists of a waiting room for departing passengers, an administration office and other facilities such as canteen, public toilet, ticketing booth, telephone booth, praying room, etc. The area of waiting room is decided based on the number of passengers of the planned ferry boat, and the equivalent of 15% of the passenger waiting room is provided for the canteen and the administration office respectively. The room for other utilities is equivalent to 25% of the waiting room, canteen and administration office. In addition to above rooms, 10% of total area is provided for public hall and passage. The total area of terminal building for each plannef ferry boat are determined as shown below;

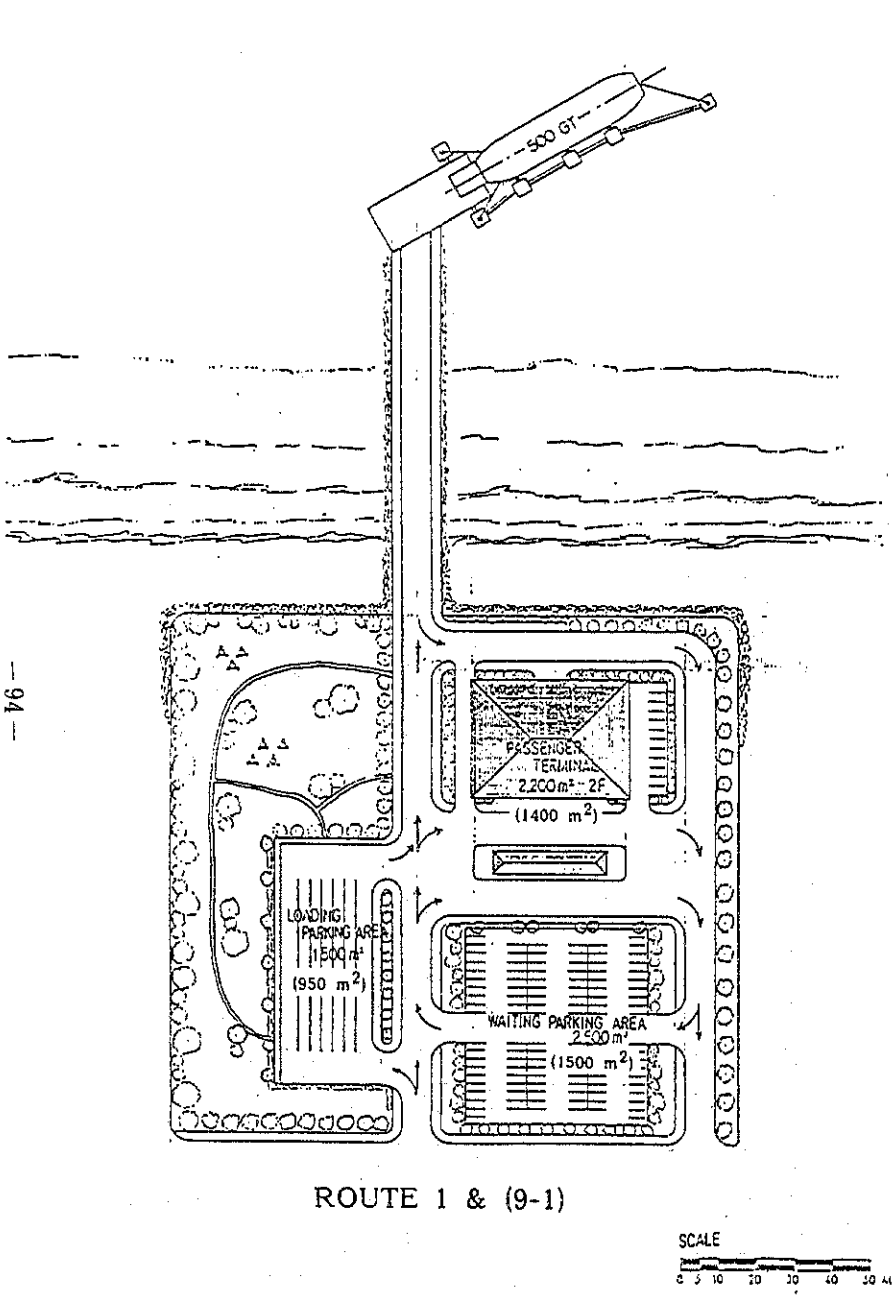
Planned Ferry Boat	Total Space of Terminal Building
150 GRT	300 m^2
300 GRT	800 m^2
500 GRT	1,400 m^2
1,000 GRT	2,500 m^2

17. Parking lots should have sufficient area both for vehicles ready for rolling on and for vehicles waiting for arriving passengers. The required area of loading parking lot and waiting parking lot for each planned ferry boat are as shown below;

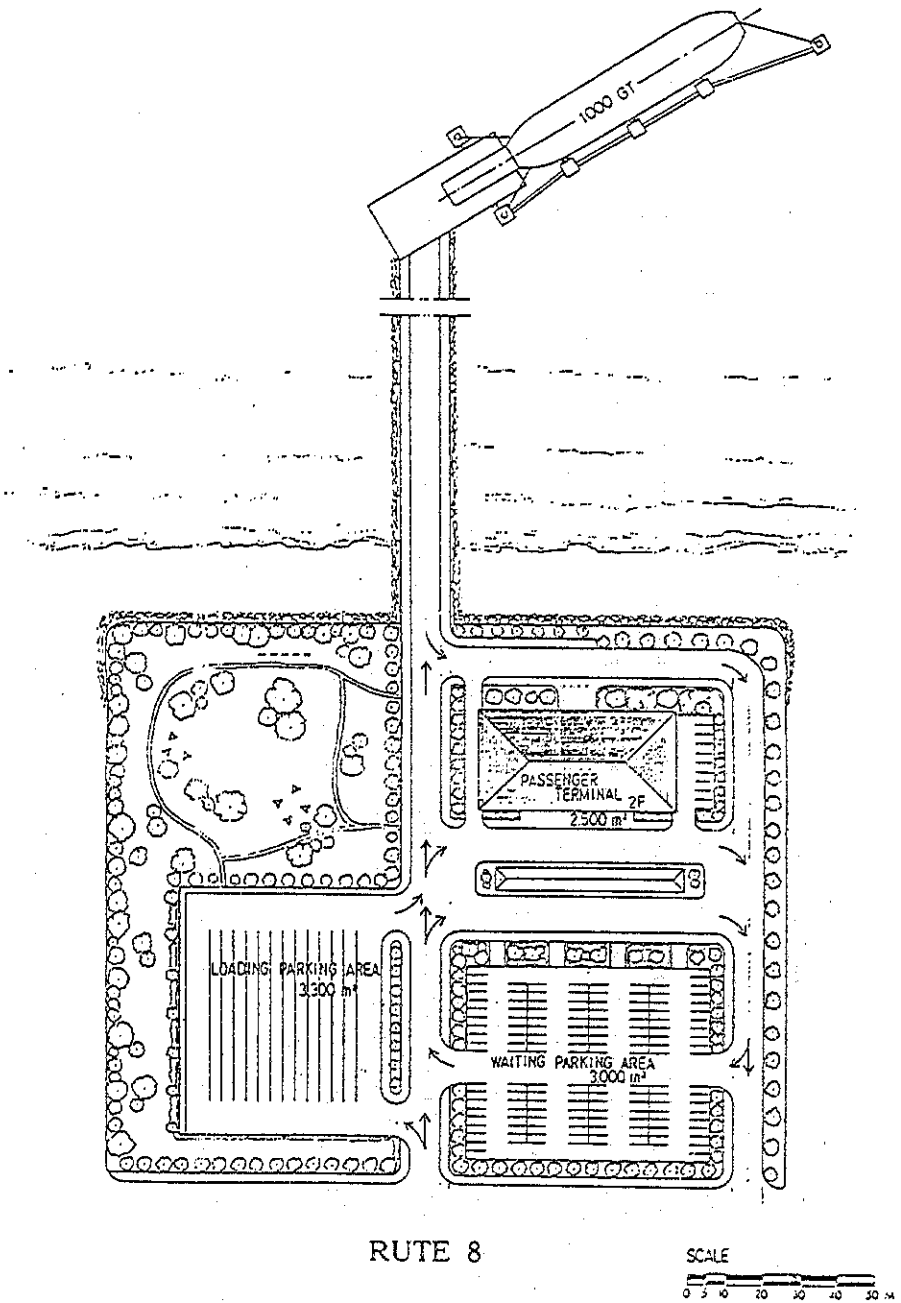
Objective Ferry Boat	Loading Parking Lot	Waiting Parking Lot
150 GRT	450 m^2	350 m^2
300 GRT	650 m^2	950 m^2
500 GRT	950 m^2	1,500 m^2
1,000 GRT	2,600 m^2	3,000 m^2

6-11 Layout of Terminal

18. The typical layouts of terminals for each route have been prepared as shown in Fig.6-4 to Fig.6-6. These layouts should be modified in accordance with the actual topographic and hydrographic situation of each terminal site.

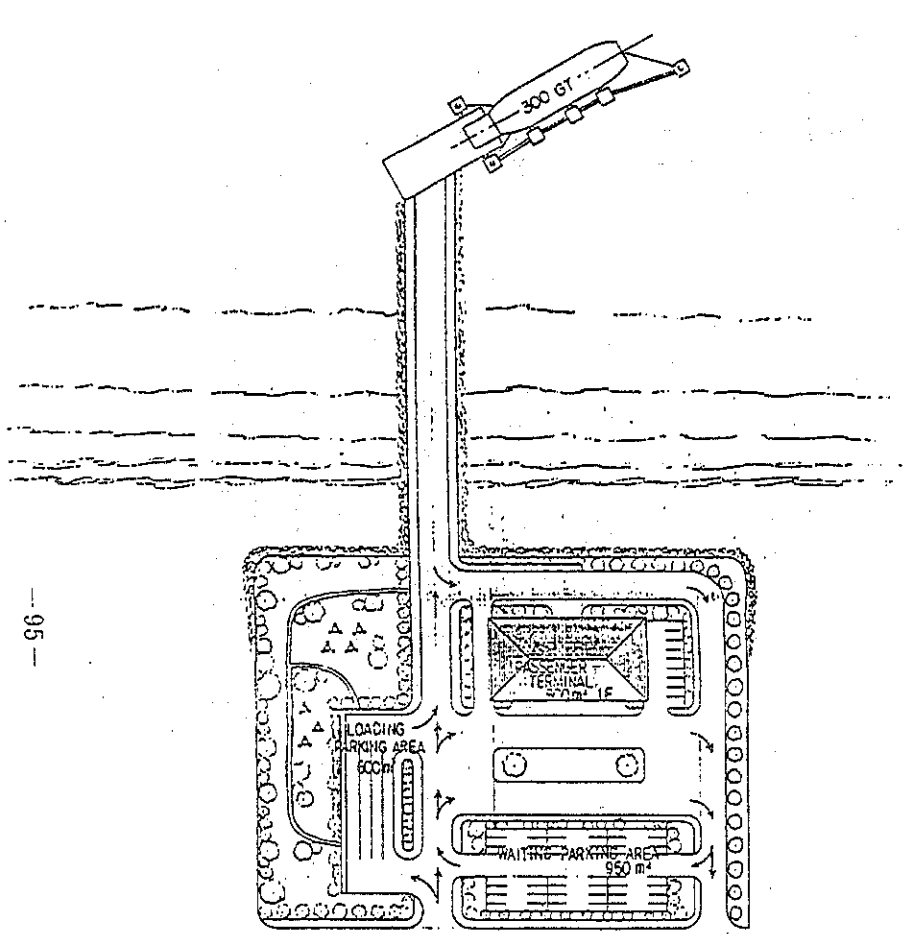


ROUTE 1 & (9-1)

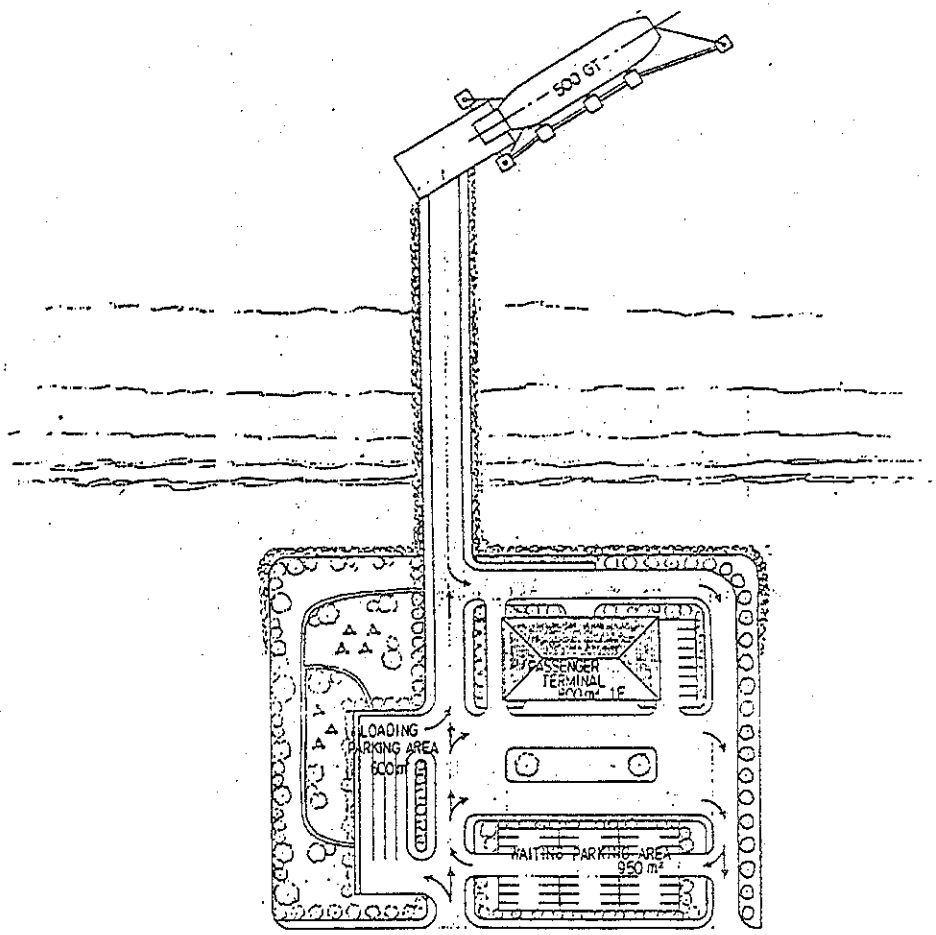


RUTE 8

Fig. 6-1 General Plan of Ferry Terminal (1)



ROUTE 2, 7 & 9-2

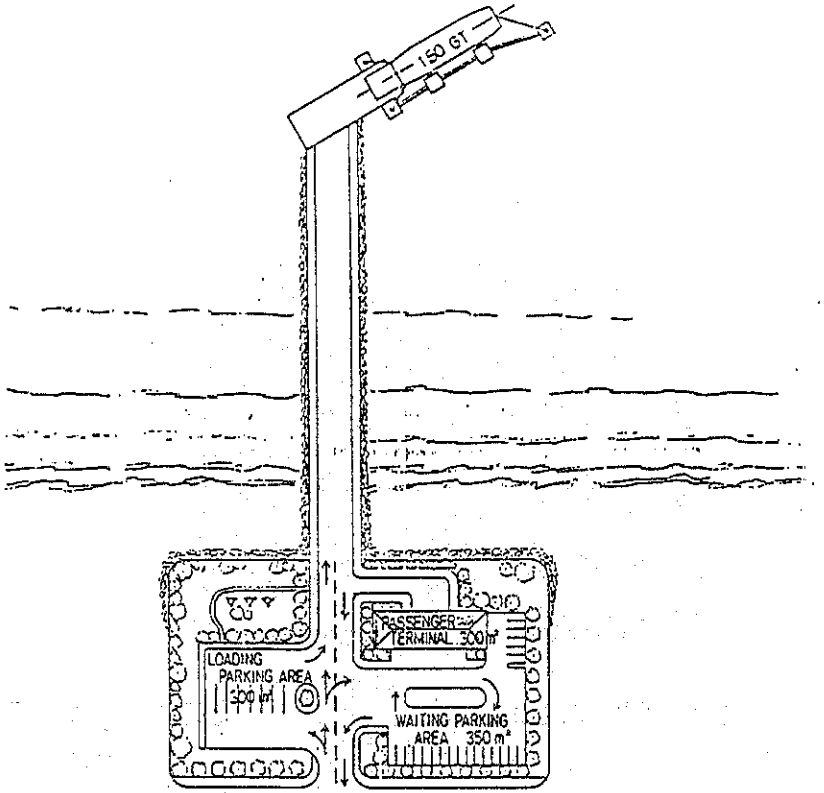


ROUTE 3

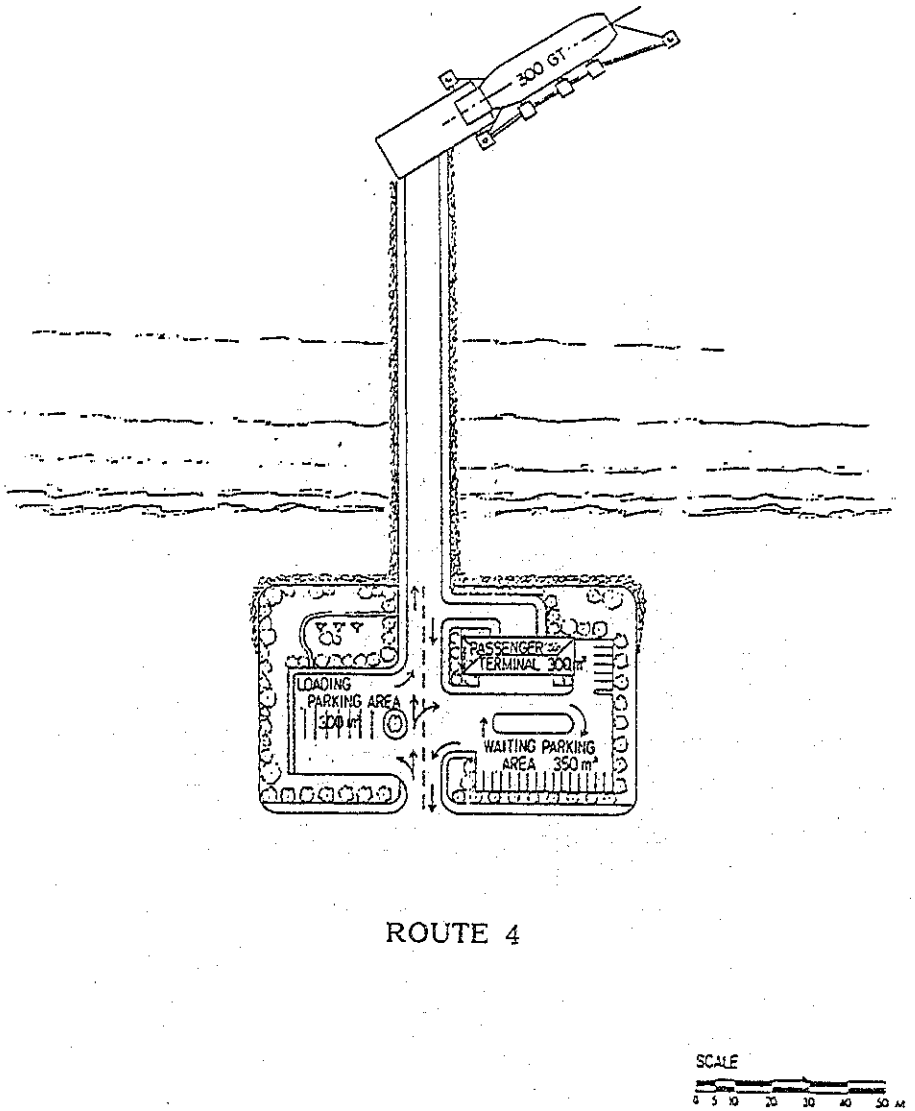
SCALE

SCALE

Fig. 6-2 General Plan of Ferry Terminal (2)



ROUTE 5 & 6



ROUTE 4

Fig. 6-3 General Plan of Ferry Terminal (3)

Chapter 7 Development Cost Estimates

7-1 General

1. During the site visit, data of the basic cost of construction works and unit prices of materials and labour were collected from the respective provinces where the proposed ferry terminals, as parts of the nationwide networks, are to be developed. The basic cost of works and unit prices for each province have been checked and the difference compared between the provinces due to availability of materials, manpower, construction equipment and accessibility to the sites in the region concerned. The capability of local contractors was checked with respect to experience of marine works and their capacity to undertake construction works of the magnitude of the planned ferry terminal facilities.

7-2 Assumption for Cost Estimation

2. The contractors working in each province are capable of carrying out the ferry terminal construction works. Accordingly the planned scope of construction works will be carried out by local contractors working in the relevant province who will mobilize and arrange procurement of the necessary equipment, materials and labourers for the works. No additional mobilization costs from Jawa island or Ujung Pandang, etc. are considered.

3. The basic costs of the works and unit prices of materials and labourers are taken from the latest applied contract prices in the relevant provincial government as collected during the site survey.

4. The construction cost was estimated by the following procedures:

a) The basic construction costs collected from each province are adjusted to the costs of 1992 with an annual increase of 10%,

b) In the case where the construction costs of particular items of work are not available in the province the basic costs of such items are taken from the nearest province and adjusted at the proportional rate

of the difference in the basic costs of works and unit prices of materials and labour,

c) The base construction costs are taken from the Ternate/Sidangole ferry terminal construction works which have all the required ferry terminal facilities and have been in progress since 1991 with the market prices of Maluk in 1990. These costs are the latest data available for a ferry terminal construction project in the eastern part of Indonesia

7-3 Cost of Ferry Boat

5. According to information obtained during the site survey, the new ferry boats to be engaged for the ferry services between the proposed terminals are being constructed in the docks of Indonesia. Their construction costs are around 2 to 3.5 billion Rp. for 300 and 500 GRT class of ferry boats, which is on the average 7 million Rp. per GRT.

7-4 Total Project Cost of Planned Ferry Routes

6. The project cost of each proposed ferry route consists of the construction/development cost of the new ferry terminal facility, the rehabilitation cost of existing facilities, and the procurement cost of new ferry boats to be engaged on the planned routes.These estimated costs include a physical contingency, consulting cost and tax on the construction cost.

7. The project costs for each route are summarized in Table 7-1.

Table 7-1 Summary of Project Cost of Each Route (1/2)

(1/2)

Route No.	Name of Terminal (Province/Island)	Exist or New	Terminal Construction Cost (Rp.)	Proposed Ship (GT)	Number of Ships	Ship Cost (Rp.)	Total Cost (Rp.)
1	HUNIMUA (Maluku/Ambon)	EXist	6,871,283,000	500			
	WAIPIRIT (Maluku/Seram)	EXist	7,005,313,000	500	2	7,000,000,000	20,876,596,000
2-1	MOKMER (Irianjaya/Biak)	New	5,182,128,000	300			
	SAUBEBA (Irianjaya/Yapen)	New	5,681,872,000	300	1	2,100,000,000	12,964,000,000
2-2	KABUAENA (Irianjaya/Yapen)	New	6,429,940,000	300			
	KIMI (Irianjaya)	New	5,198,145,000	300	1	2,100,000,000	13,728,085,000
3	LARANTUKA (NTT/Flores)	EXist	1,493,520,000	500			
	KALABAHI (NTT/Alor)	New	7,150,827,000	500			
	TERONG (NTT/Adonara)	New	8,497,710,000	500			
	LEWOLEBA (NTT/Lomblen)	New	6,173,550,000	500	2	7,000,000,000	36,954,850,000
	BARANUSA (NTT/Pantar)	New	6,639,243,000	500			
4	SIKELI (SE.Sulawesi/ W.Kabaena)	New	4,417,858,000	300			
	PULEMO (SE.Sulawesi)	New	4,204,843,000	300	1	2,100,000,000	6,304,843,000

Table 7-1 Summary of Project Cost of Each Route (2/2)

(2/2)

Route No.	Name of Terminal (Province/Island)	Exist or New	Terminal Construction Cost (Rp.)	Proposed Ship (GT)	Number of Ships	Ship Cost (Rp.)	Total Cost (Rp.)
5	DONGKALA (SE.Sulawesi/ E.Kabaena)	New	4,309,370,500	150			
	MAWASANGKA (SE.Sulawesi/ W.Muna)	New	5,335,258,000	150	1	1,100,000,000	10,744,628,500
6	KENDARI (SE.Sulawesi)	New	3,441,280,000	150			
	LANGGARA (SE.Sulawesi/ Wawonii)	New	4,078,395,000	150	1	1,100,000,000	8,619,675,000
7	GORUA (Maluku/ Halmahera)	New	5,350,075,000	300			
	DARUBA (Maluku/Daruba)	New	8,351,755,000	300	1	2,100,000,000	15,801,830,000
8	BAJOE (SE.Sulawesi)	Exist	13,706,940,000	1000			
	KOLAKA (SE.Sulawesi)	Exist	9,126,725,000	1000	5	35,000,000,000	57,833,665,000
9-1	PALEMBANG (S.Sumatra/ Sumatera)	Exist	9,033,688,000	500			
	MUNTOK (S.Sumatra/ Bangka)	New	8,385,508,000	500	2	7,000,000,000	24,419,196,000
9-2	SADAI (S.Sumatra/ Bangka)	New	4,821,723,000	300			
	TANJUNG BARONG (S.Sumatra/ Belitung)	New	4,825,323,000	300	1	2,100,000,000	11,747,046,000

Chapter 8 Priority Study of the Planning Routes

8-1 Selection of Evaluation Items

(1) The Ideas for the Selection of Evaluation Items

1. Evaluation items which can be quantified are selected for easy comparison and evaluation among the proposed routes.

The items related to the demand volume of cargo/passengers transported by ferry should be most important from the view point of the feasibility of ferry service. However, the policy of the Indonesian Government to develop the economically retarded regions should be taken into account for the selection of the evaluation items.

The regional balance of the development of ferry routes, which has a large impact on regional development, should also be taken into account for the selection of evaluation items.

(2) Selected Evaluation Items

2. The selected evaluation items are as follows:

1) Ferry Transportation Demand
   i) Passenger Demand in 2010
   ii) Cargo Demand in 2010

2) Project Scale
   i) Development Cost of Ferry Service

3) Development Efficiency
   i) Ratio of "development cost per one passenger"
   ii) Ratio of "development cost per one tonnage of cargo"

4) Necessity of Reinforcement/Improvement of the Existing Sea Transportation Services
   i) Existence of ferry service
   ii) Service level of existing conventional sea transportation (Items to provide information to compare the relative necessity of the

development of new ferry route on the route/region of retarded sea transportation infrastructures)

5) Others

i) Item to judge regional balance of ferry service network development

Items 1) - 3) are used to judge the necessity of ferry service development from the viewpoint of demand potential.

Items 4 and 5) are used to judge the necessity of ferry service development from the viewpoint of regional development policy(infrastructure development related to regional development).

(3) Routes to be Evaluated

3. Although there are nine routes according to the Master Plan, the actual number is thirteen; both Route 2 and Route 9 comprise two separate routes, while Route 3 is comprised of three, as seen below:

Route 2-1: Biak Island-Yapen Island
Route 2-2: Yapen Island-Irian Jaya(Nabire)

Route 3-1: Flores Island-Adonara Island-Lomblen Island
Route 3-2: Alor Island-Pantar Island
Route 3-3: Flores Island(Larantuka)-Alor Island(Karabahi)

Route 9-1: Palembang-Bangka Island
Route 9-2: Bangka Is land-Belitung Island

(4) Results of Evaluation

4. According to the evaluation items and criteria, the thirteen routes are evaluated as shown in Table 8-1. The evaluation criteria are shown in the "Note" of the Table. Two to four evaluation ranks are presented for each items. A double-circle mark indicates the highest priority and a black triangle mark, the lowest priority.

Table 8-1 Route Selection for Feasibility Study

Route	Evaluation Items and Evaluation								Route Selection for Feasibility Study	
	①		②	③		④		⑤	Alternative-A	Alternative-B
	①-1	①-2		③-1	③-2	④-1	④-2			
1	◎	○	○	◎	◎		○	○		
2-1	○	△	△	◎	◎	◎	◎	◎	◎	◎
2-2	▲	▲	△	▲	▲	◎	◎	◎		
3-1	○	○	△	◎	◎		○	△	◎	◎
3-2	△	▲	△	○	△	◎	○	△		
3-3	▲	▲	△	○	△	◎	◎	△		
4	▲	▲	▲	△	△	◎	◎	◎		◎
5	▲	▲	△	▲	▲	◎	◎	◎		
6	▲	▲	▲	△	△	◎	○	◎		
7	○	▲	△	○	○	◎	◎	○		◎
8	◎	◎	◎	◎	◎		○	◎	◎	
9-1	○	○	○	○	◎		○	◎	◎	
9-2	△	▲	△	○	○		◎	◎		

① Demand Volume/Year(2010)
①-1 Number of Passengers/Year(2010)
①-2 Volume of Cargo/Year(2010)
② Project Scale(Construction Cost)
③ Development Efficiency
③-1 (①-1)/②
③-2 (①-2)/②
④ Necessity of Reinforcement/Improvement
④-1 Existing of Ferry Service
④-2 Convensional Sea Transportation
⑤ Number of Existing Ferry Route in the Related Province

5. Table 8-1 shows that the national trunk route and the regional trunk routes have been given high priority on the items related to demand potential and regional routes have given high priority on the items related to the necessity of development from the viewpoint of the regional development policy.

8-2 Route Selection for the Feasibility Study

8-2-1 Alternative Ideas for Route Selection

(1) Alternative-A

6. All of the proposed nine routes for the Master Plan(actually thirteen routes) are the subject of evaluation for the Feasibility Study. Based on the classification of the characteristics of the Planning Routes(Table 1-1-1, Chapter 1, Part 2), the selection for the Feasibility Study is conducted according to the importance of the route's role in the nationwide ferry network development, that is, the highest priority is given to the national route, followed by regional trunk routes. Among the local routes, the ferry routes with high ferry transportation demand are selected.

7. In the selection mentioned above, considering the necessity to extend the development of ferry network as widely as possible, the existing routes in which the ferry services have already been provided are given a lower priority. The manner in which routes are prioritized is demonstrated as follows.

1) Extension work for existing terminal facilities is not so large and it is possible to be conducted with Indonesian Government's budget and technology. In such a case, the priority for the selection should be placed at a in lower level to give higher priority to the others. Route 1 corresponds to this case.
2) On an existing route which provides poor ferry service, an alternative ferry route is required and consequently the construction of a new ferry terminal is also required. This should be regarded not as an existing route but as a new one. Route 9-1 corresponds to this case.
3) Though passengers/cargoes transportation is now operated by ferry boat, the mooring facilities are not specialized for roll on/roll off system which is indispensable for ferry service and thus the

construction of exclusive ferry terminal facilities is required. This also should be regarded as a new route. Route 3-1 and Route 9-2 correspond to this case.

(2) Alternative-B

8. Social capital in Indonesia has mainly been invested in the Western Area(Jawa and Sumatra Islands) while the Eastern Area has remained undeveloped. The development of the ferry transportation network also shows the same tendency. Thus, further development of the ferry network in the Eastern Area is required as a trigger for regional development. Routes 9-1 and 9-2 which are located in the Eastern Area are excluded from the Feasibility Study routes.

9. Wide ferry network development is urgent as a fundamental infrastructure to promote total and balanced economic development in the Eastern Area and high priority should be given to new routes. (Here the definition of a new route is given in "(1) Alternative-A".) Thus, Route 1 and 8 are excluded from the Feasibility Study routes.

10. Further consideration is given to regionally balanced development of the ferry network. Considering the above selected nine routes, the area is divided into four regional groups as follows:

1) North area of Irian Jaya Province
   Route 2-1 and 2-2
2) North area of Nusa Tenggara Province
   Route 3-1, 3-2 and 3-3
3) South area of Southeast Sulawesi Province
   Route 4, 5, 6
4) North area of Maluku Province
   Route 7

8-2-2 Route Selection Based on Two Alternative Ideas

(1) Route Selection Based on the Idea of Alternative A

11. The selected routes based on the Alternative A are Routes 8, 9-1, 3-1

and 2-1 as shown in Table 8-1.

12. Route 8 is an existing route and is considered as a national trunk route in formulating a nationwide ferry network. Both passenger and cargo transportation volume on this route are the largest among those of the thirteen study routes. Extension cost for this route is also the highest.

13. Route 9-1 is considered as a regional trunk route. In terms of future transportation demand volume, the number of passengers is the third largest, the volume of cargoes, the second and the construction cost, the second. Ex-route 9-1 has a large defect in that a ferry must wait for high tide for a few hours because of the shallow water depth in the mouth of the river.

14. Route 3-1 and 2-1 are new routes that are considered to compose new local networks.

(2) Route Selection Based on the Idea of Alternative B

15. Four selected routes from each regional groups are as follows(shown in Table 8-1):

North area of Irian Jaya Province: Route 2-1
North area of Nusa Tengarra Timur Province: Route 3-1
South area of Southeast Sulawesi Province: Route 4
North area of Maluku Province: Route 7

16. There are two proposed routes in the north area of Irian Jaya Province. No difference in the necessity of the reinforcement of sea transportation is not found between the two routes. Route 2-1 is connected directly with Biak City of Biak Island, the economic center of this region and the length of the route is far shorter than that of Route 2-2; consequently, the volume of ferry transportation of Route 2-1 is far larger than that of Route 2-2. Route 2-1 is selected as the Feasibility Study route of this area.

17. The three routes in the north area of Nusa Tengarra Timur Province were once proposed as a single route. Based on the field survey, this proposed route was considered to formulate local ferry networks and was divided into three routes. Each route will be developed based on its own requirements for the

improvement of transportation in each related area.

18. Of the three divided routes, both Routes 3-1 and 3-2 are short in distance and sea transportation service now is provided mainly by small-sized conventional vessels. Route 3-3 is long and interregional economic exchange between two areas to be connected by ferry is very small compared with the other two routes; this tendency will continue for a long time.

19. The ferry transportation volume of Route 3-1 is estimated to be the largest among the three and ferry service has been provided although the mooring facilities now used are insufficient. Based on the above evaluations, Route 3-1 is selected as the Feasibility Study route in the north area of Nusa Tengarra Timur Province.

20. The three routes in the south area of Southeast Sulawesi Province are new routes and are almost the same in terms of ferry transportation demand volume and the necessity of reinforcement of sea transportation. The current situation on the interregional connection of the three islands concerned with the main island of Sulawesi is that Muna Island has already been connected with the main island and Wowonii Island is a short distance from Kendari, the capital of Southeast Sulawesi Province and daily sea transportation is provided by small-size conventional vessels. On the other hand, the interregional connection of Kabaena Island with the main island is relatively small. Based on the above evaluations, Route 4 is selected as the Feasibility Study route in the south area of Southeast Sulawesi Province to support the reinforcement of interregional connection with the main island.

21. The north area of Maluku Province has only one candidate route, then Route 7 is selected as a Feasibility Study route.

(3) Selection of Alternative for the Feasibility Study

1) Proposal by the Study Team

22. The study Team proposed the route selection by Alternative A for the reasons mentioned below:

a) The development of ferry routes, based on the national master plan to

formulate the nationwide ferry network, should be conducted considering the characteristics and requirements of routes concerned. Selection by this Alternative will be appropriate to reflect the above concept.

b) Demand potential of ferry transportation is an essential element in examining the feasibility in the short term plan.

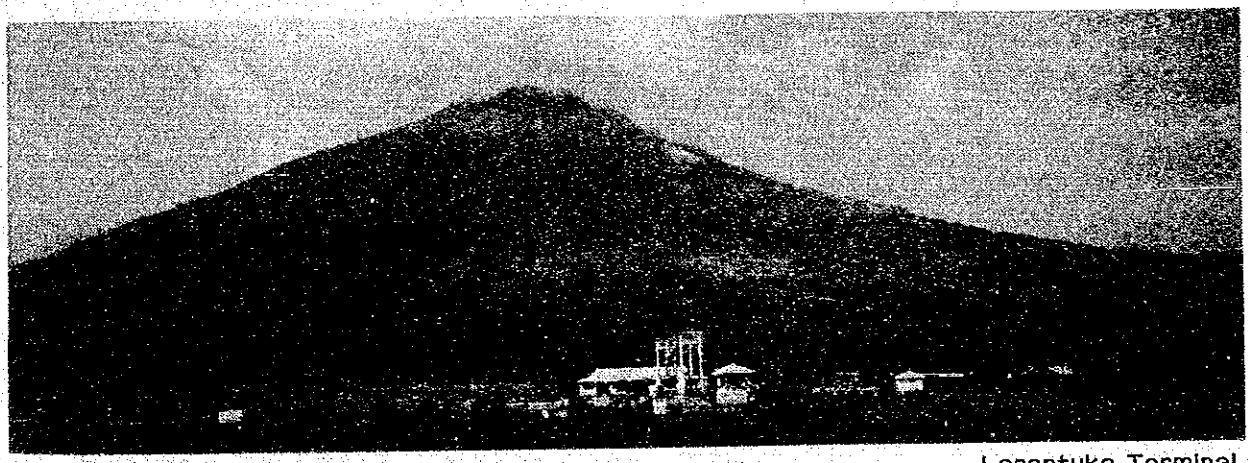
c) Of the four selected routes based on this Alternative, three routes are located in the Eastern Area of Indonesia which coincides with Indonesian policy to develop the Eastern Area.

2) Conclusion on the Feasibility Study Routes

23. Directorate General of Land Transportation and Inland Waterways (DGLT) supported Alternative-B to develop mainly new routes at first and furthermore requested that not only four routes but also other routes would be applied as Feasibility Study routes and expected the support of Japan's OECF loan. Thereafter, DGLT judged that other financial resources would be allotted on the routes which would not be included in the feasibility Study or in the projects by OECF loan. Furthermore, Perum ASDP who must always consider the profitability of ferry service, supported Alternative A. Finally, steering committee accepted the proposal of the study Team.

PART 3

SHORT-TERM DEVELOPMENT PLAN ON FOUR FERRY ROUTES AND FEASIBILITY STUDY



Larantuka Terminal

Larantuka Terminal

Chapter 1 Basic Ideas for Short-term Development Plan

(1) Contribution to Regional Development

1. In Indonesia, the opening of ferry service has contributed largely to the development of the regions connected by a ferry and public roads through the daily movement of various commodities and passengers. To further such contribution to regional development, a ferry terminal plan should satisfy the following items:

1) Smooth movement of cargoes/passengers should be provided between origin and destination through ferry, ferry terminal and public roads linked with the ferry terminal.
2) Passenger terminal should provide all necessary facilities to meet passengers' needs.
3) On-land ferry terminal will be the center of the community and should satisfy the requests of residents of the region by providing business opportunities and a comfortable environment.

(2) Stage Development according to the increase of passenger/cargo demand

2. Based on the Master Plan up to the year of 2010, ferry terminal facilities should be developed step by step according to the increase of passenger/cargo demand. On-land facilities(passenger terminal, parking lot etc.)based on the Master Plan will be extended step by step with the increase of passenger/cargo demand. On ferry routes where a smaller ferry is introduced in the short-term plan(1998)even though a larger ferry will be introduced in long-term plan(2010), the size of on-land facilities should be planned according to the smaller ferry.

3. For the mooring of ferry-boat, one berth is enough to cope with the demand of passenger/cargo even in 2010 for each of the four Feasibility Study routes. Unlike on-land facilities, mooring facilities and water depth of a basin should be sufficient in capacity for the ferry which will be introduced in long term plan(2010); for example, water depth of basin in front of the mooring facilities should be able to accommodate the maximum ferry to be introduced in 2010 on each route even if smaller ferry-boats are introduced in the first stage of the development of the study ferry route.

(3) Introduction of the optimum ferry

4. In the Master Plan, the size of ferry has been determined taking account of the following two points; the volume of passenger/cargo and the maritime condition of the ferry route. To make a detailed ferry operation plan, it is indispensable to set up the capacities of a ferry(maximum embarking capacity of passengers, maximum loading capacity of cars, navigation speed of ferry etc.) These capacities will be decided based on the ferry-boats to be used now and to be constructed in future in Indonesia etc..

(4) Planning of ferry operation time schedule based on user's availability

5. Mokmer(Biak)-Sabubeba(Yapen) and Larantuka(Flores)-Terong(Adonara)-Lewoleba(Lomblen)are short-distance routes and ferry operation is in day time. According to the demand forecast of passenger/cargo in 1998, one round trip is enough for the two ferry routes but it is essential to plan a ferry operation time schedule(departure and arrival times from/at both sides of ferry route), taking account of ferry users' daily traveling time zone.

6. In Bajoe-Kolaka and Palembang-Muntok routes, the departure and arrival times should be decided taking account of the origins and destinations of passengers and cargoes(for example mainly from/to Palembang and Pangkal Pinang in the former route and Ujung Pandan, Bajoe, Kolaka and Kendari in the latter route). The two routes are used for trips of duration and thus it is necessary to increase the service facilities in the ferry passenger terminal and the ferry itself.

7. Most of the study ferry terminals are located a little far from public land transportation routes and it is difficult for passengers to use public land transportation means directly. Therefore, an appropriate area in the terminal should be prepared as a parking lot for mini buses for passengers to have an access means to their destinations.

(5) Layout of facilities and construction plan taking account of surrounding environmental conditions

8. Design of structures and construction work plan of ferry terminal should be made taking account of its effect on the surrounding environment. Mooring facilities should be installed at an appropriate location so as not to disturb the activity of the other existing means of sea transportation and the fishery in the sea area related to the operation of ferry.

9. After a ferry arrives at a terminal, many vehicles(loaded trucks & cars and mini bus for general passengers)leave the ferry terminal for various destinations. The road connecting the ferry terminal with these destinations will thus be occupied by these vehicles. The location of the entrance of the access road to ferry terminal should be decided so as not to disturb the flow of traffic on the access road and the capacity of the road should be sufficient to receive the impact of the vehicles from the ferry terminal.

Chapter 2 Natural Conditions

2-1 Field Survey

In order to obtain the present natural conditions on planned ferry terminal sites for the feasibility study, the topographic and hydrographic survey, the tide and current observations and the soil investigations were carried out from September to November, 1992.

2-2 Tide

The tide type at Palembang and Muntok are diurnal, and the tide type of other terminal sites are mixed semi-diurnal.

The tide range between NLLWL and NHHWL of each terminal site are as follows:

Site	Tide Range	Site	Tide Range
Mokmer	1.55 m	Saubeba	1.59 m
Terong	2.95 m	Lewoleba	2.14 m
Bajoe	2.32 m	Kolaka	2.53 m
Palembang	4.10 m	Muntok	4.12 m

2-3 Current

The observation of currents showed that the velocity of the currents at all the ferry terminal sites are less than 2 knots, and ship maneuverability will not be adversely affected by the current.

2-4 Wave

Waves in Mokmer, Saubeba and Muntok will affect the ferry operation but no wave data were available. Therefore, waves in these sites were forecast

from the wind data over a period of more than 10 years. Based on the forecast results, the following design waves have been determined for each terminal site;

Site	Wave Height ($H_{1/3}$)	Wave Period ($T_{1/3}$)	Direction
Mokmer	3.0 m	4.8 sec.	WSW
Saubeba	3.0 m	4.2 sec.	W
Muntok	1.0 m	4.0 sec.	SSE

2-5 Soil

The subsoil in Mokmer site is medium to dense white sand with coral. The bearing layer for pile foundation appears to be about 13 to 15 m below surface.

The subsoil on land in Saubeba site is covered by medium dense fine sand about 7 m thick. Underneath this layer is dense to very dense fine sand with coral. The surface layer of offshore subsoil is medium dense sandy gravel, about 3 m thick. Below this medium to dense white sand with coral layer is observed, and the bearing layer for pile foundation appears around 15 m below the sea bottom.

The subsoil in Terong site consists of very dense sandy gravel and gravely sand. Therefore, gravity type foundation is recommended for this terminal.

The subsoil in Lewoleba site consists of medium to dense black sand and gravely sand. The bearing layer for pile foundation is about 25 m below the surface.

At Bajoe site, the land facility area is covered by loose to medium dense gray sand with a coral layer 2 to 3 m thick. Underneath this layer there is soft to hard whitish yellow lime stone. The offshore facility area is covered by loose grayish brown silty clay layer about 5 m thick. Under this layer, a lime stone layer is observed.

The subsoil in Kolaka site is very poor at both the land facility area and the offshore facility area. Two(2) borings were executed to 30 m below the surface, however, a suitable bearing layer could not be discovered.

The surface layer of subsoil in Palembang site is about 6 to 9 m thick and very soft silty clay, and the second layer is soft clayey sand about 10 m thick. The third layer is fine sand with a N-value of 30 to 57, and could be the bearing layer for a foundation pile.

The subsoil of land facility area in Muntok site is quartz sand more than 9 m thick with a N value of more than 40. The subsoil of offshore facility area consists of 2 m thick soft sandy clay, 12 m thick very soft clay, 2.5 m thick dense sand and the sandy gravel bottom layer with a N-value of more than 50.

Chapter 3 Forecast of Ferry Transportation Demand for Short Term Plan

To prepare the Short-Term Plan up to the year of 1998 of the Nationwide Ferry Service Routes in Indonesia, a demand forecast is carried out to project the traffic volume of passengers, cargoes and vehicles in respective target year.

3-1 Future Socioeconomic Framework

3-1-1 Population

The forecasting method of future population is described in Chapter 3 of Part II.

Table 3-1 Population in 1998 (unit:thousamd Persons)

	1990	1990-1995	1996-2000	Population(1998)
Naluku	1,858	2.45%	2.13%	2,234
East Nusa Tenggara	3,269	2.10%	1.83%	3,830
South Sumatra	6,277	2.70%	2.35%	7,689
Irian Jaya	1,641	2.97%	2.97%	2,074
Southeast Sulawesi	1,350	3.08%	3.08%	1,721

3-2 Demand Forecast

The method of demand forecast is described in Chapter 3 of Part II. The result is shown in Table 3-2.

Table 3-2 Result of Demand Forecast in 1998

No.	Passenger		Cargo	Truck	Sedan	Total	V-2
	1990	1998	1998	1998	1998	1998	1998
2-1		67,000	2,900	1,400	1,900	3,300	3,000
3-1'		62,000	3,600	1,700	1,900	3,600	2,300
3-2'		62,000	3,600	1,700	1,900	3,600	2,300
8	304,738	522,000	83,000	14,000	15,000	29,000	9,000
9-1	81,119	190,000	21,000	10,000	5,500	15,500	9,000

2-1 Mokmer - Sabuaena
3-1' Larantuka - Terong
3-2' Larantuka - Lewoleba
8 Bajoe - Kolaka
9-1 Palembang - Muntok

Chapter 4 Short-term Ferry Operation Plan

4-1 A Basic Line for Ferry Operation Plan in Short-term Plan

(1) Criteria for Selection of Optimum Ferryboat on each Route

1) Securing seaworthiness of the ferryboat against weather/sea condition of her commissioned sea area

1. THE MASTER PLAN STUDY has provided details of weather/sea conditions for the entire Indonesian Sea Area by referring to INDONESIAN PILOTS. In addition to this, we have taken new information which obtained through the field survey into consideration and assumed the possible hostile weather/sea conditions of each route during a normal year. Selection of an appropriate ferryboat shall begin by first establishing whether she is seaworthy against the natural conditions of the route.

2) Consideration of other conditions relevant to the ferry operation.

2. Besides, we gave consideration of following matters in selecting the appropriate ferryboat, providing facilities and planning ferry operation.

* Depth of water around berth, in the turning basin,
* Length, depth, bends and any navigational hazard in the approaching passages,
* The situation of navigational aids and their maintenance,
* Availability and conditions of water/fuel/power supply to ferryboat/terminal facilities,
* Nearest ship repairing facilities.

3) Meeting the traffic demand and concluding selection of the optimum ferryboat by route.

(2) Planning Method for Frequency of Round Trip of Ferryboat

3. The required frequency of round trip per day on a given route in 1998 can be derived by the same estimating system as THE MASTER PLAN STUDY from the traffic demand of passengers and cargoes, respectively.

4. And, the practical service frequency of a given route should adopt the higher one of the above two estimations.

5. Further, the frequency and time zone of the service should, as far as practicable, comply with user's convenience e.g.:

* Planning daytime service in principle from the viewpoint of navigation safety,
* Maintaining minimum service frequency of once a week,
* Connecting with existing ferry service,
* Considering the time required between a terminal and users' origins or destinations,
* Planning a favorable time zone for users.

4-2 Detailed Operation Plan

(1) Biak(Mokmer) - Yapen(Saubeba)Route

1) Local weather/sea conditions

6. In this region winds rather than temperature mark the change of seasons, the prevailing winds change from the NW monsoon(November-March)to the SE monsoon(May-September).

7. During the SE monsoon the wind is not generally very strong, but during this period a strong, hot and dry wind known as the **"Wambrau"** come from the SW; these winds may last from four to eight days, during which vessels may have to seek shelter off the N and E coasts of Biak.

8. During the NW monsoon the wind is usually very strong; repeated heavy W'ly squalls called **"Wamanda"** by the Papuans, come almost unexpectedly from W and WSW on the S coast of the Biak.

9. A well-experienced navigator issued the following warning: when a Barrat(NW winds)prevailing, maneuvering a vessel alongside a jetty on the N coast of Yapen would be particularly difficult.

2) Traffic demand

10. According to the estimated traffic demand in 1998, the required service frequency by 300GRT ferryboat for passengers is 0.6, and is 0.4 for cargoes(cars), which means one round trip daily service is appropriate enough on this route.

11. An official of Serui concerned with local transport informed us that the road between Serui and Saubeba is scheduled to be completed within the 93-94 fiscal year, then a consistent traffic route by car and ferryboat will promise more convenient transport and rising traffic demand.

3) Ferryboat

12. The desired type of ferryboat derived from both of the weather/sea conditions and the traffic demand is C, whose principal dimensions are as follows:

Gross Register Tonnage	:	300
Length over all	:	38.5m
Breadth	:	10.5m
Draft in full	:	2.2m
Service Speed	:	11 kt
Passengers	:	300
Cars	:	11 (8^{t}-Truck)

13. Since the distance between two terminals is about 31 miles(57km), the above mentioned ferryboat would be able to complete a single voyage within three and a half hours at longest, consequently, she may thus be expected to complete one daytime round trip before sun set.

4) Timetable of ferry operation

14. After considering all the factors, a model time table is shown in Fig.4-1.

(2) Larantuka - Terong - Lewoleba Route

1) Local weather/sea conditions

15. This route is a inland waterway surrounded by Flores Is., Adonara Is. and Lomblen Is. and is favored by a mild weather. No weather warning to vessels sailing on this areas is found in THE INDONESIAN PILOT. Although strong tidal streams and eddy peculiar to narrow straits and the joint of streams are dangerous for small craft, not so serious for desired ferryboat of power-driven with steel hull, as far as the ferry is properly operated.

2) Traffic demand

16. According to the estimated traffic demand in 1998, the required service frequency by 300GRT ferryboat is as Table below.

Table of required service frequency

Route from	to	Passengers 300 persons/trip	Cars $20/3^{t}$-T
Larantuka	- Terong	1.05	0.73
Terong	- Lewoleba	0.53	0.37

17. Consequently, one round trip daily service is appropriate enough on this route.

3) Ferryboat

18. The desired type of ferryboat derived from both the weather/sea conditions and the traffic demand of this route is C, whose principal dimensions are as follows:

Gross Register Tonnage	:	300
Length over all	:	38.5m
Breadth	:	10.5m
Draft in full	:	2.2m
Service Speed	:	11 kt
Passengers	:	300
Cars	:	11 (8^{t}-Truck)

19. By putting a 300GRT ferryboat for exclusive use on this route, it would be needless to maintain the extended service from Larantuka to Lewoleba by existing fleet. As a result, the surplus ferryboat could be allocated to the isolated island lines of Savu Sea to provide much better transporting capacity to meet the rising traffic demand in these lines.

4) Timetable of ferry operation

20. After considering all the factors, a model time table is shown in Fig.4-2.

(3) Bajoe - Kolaka Route

1) Local weather/sea conditions

21. The route connects either coasts of Bone Bay is situating in the calm belt known as Doldrums, no particular weather warning is found in the INDONESIAN PILOT.

2) Traffic demand

22. According to the estimated traffic demand in 1998, the required service frequency by 1000GRT ferryboat is as Table below. The rising demand of this route is most remarkable among the four study route.

Table of required service frequency

Route from to	Passengers 600 persons/trip	Cars $27/8^{t}$-T
Bajoe - Kolaka	3R.T.(2.21)	2R.T.(1.85)

23. The present transporting capacity with five ferry boats under service will be insufficient to meet the estimated demand in 1998. The annual shortage of capacity will reach more than 110,000 passengers, which nearly corresponds with an "A" type ferryboat's(1,000GRT)capacity. An "A" type ferryboat should additionally be introduced on this route, accordingly.

3) Ferryboats

24. In addition to the five existing ferryboats which will maintain their service still in 1998, an 1,000GRT ferryboat should be introduced on this route.

25. Almost all existing ferryboats under service will be overaged in 1998, and consequently, the replacement of a certain number of overaged ferryboats should also be considered.

4) Timetable of ferry operation

26. After considering all the factors, a model time table is shown in Fig.4-3.

(4) Palembang - Muntok Route

1) Local weather/sea conditions

27. In Slat Bangka the general wind directions are a steady SE from April to October, and the NW monsoon is relatively constant from January to March. Squally weather is most marked in the NW monsoon characterized by greater activity at night. Appreciable seas occur when fresh winds oppose the tidal streams.

28. In addition to the above, we obtained the following information : "the most hostile winds/seas on and around the sea front of Muntok are SE'ly ones, which are derived from the prevailing SE monsoon during May to September, while the NW monsoon is lesser in effect than the SE monsoon".

2) Traffic demand

29. According to the estimated traffic demand in 1998, the required service frequency by a 500GRT ferryboat is as Table below.

Table of required service frequency

from	to	500 persons/trip	$15/8^{t}$-T
Palembang	- Muntok	1R.T.(0.96)	1R.T.(1.15)

30. Although daily one round trip service will be maintained on this route by the two existing ferryboats, their full transporting capacity will be insufficient in 1998 to meet the rising traffic demand.

31. The annual shortage of capacity will reach about 150,000 passengers, and 9,000 cars, thus, it is necessary to introduce an additional ferryboat to cope with the practical traffic situation.

3) Ferryboat

32. Although the two existing ferryboats will maintain their service still in 1998, the "B" type(500GRT)ferryboat is desired as an additional one to meet the high traffic demand inherent in this route. Besides, replacement of the two existing overaged ferryboats is one of problems by which the operator would be confronted.

4) Timetable of ferry operation

33. After considering all the factors, a model time table is shown in Fig.4-4.

4-3 Recommendation for Planning Navigational Aids

34. According to information from the DGLT, no serious marine accidents have occurred as far as the ferry operation is concerned so far. The major reason that the actual number of accidents is small is the low traffic volume/density, and the relatively favorable weather/sea conditions in these areas; further, experienced shiphandlers have maintained ferryboat operations through careful maneuvering.

35. Nevertheless, experience has shown that proper arrangement of necessary navigational aids is required for preventing sea accidents as a effective "shore-based service".

36. Desiring to ensure the greatest degree of safety and lighten the mariner's burden, and considering that the present situation of the navigational aids concerning the study routes is not enough except Musi River passage, the team recommend additional installation or replacement of the minimum essential navigational aids as Table 4-1.

DISTANCE	: 31 MILE
TIME REQUIRED	: 3^{h}-10^{m}
VESSEL	: 300 GRT, 11^{kt}
SERVICE FREQUENCY	: ONE ROUND TRIP/DAY

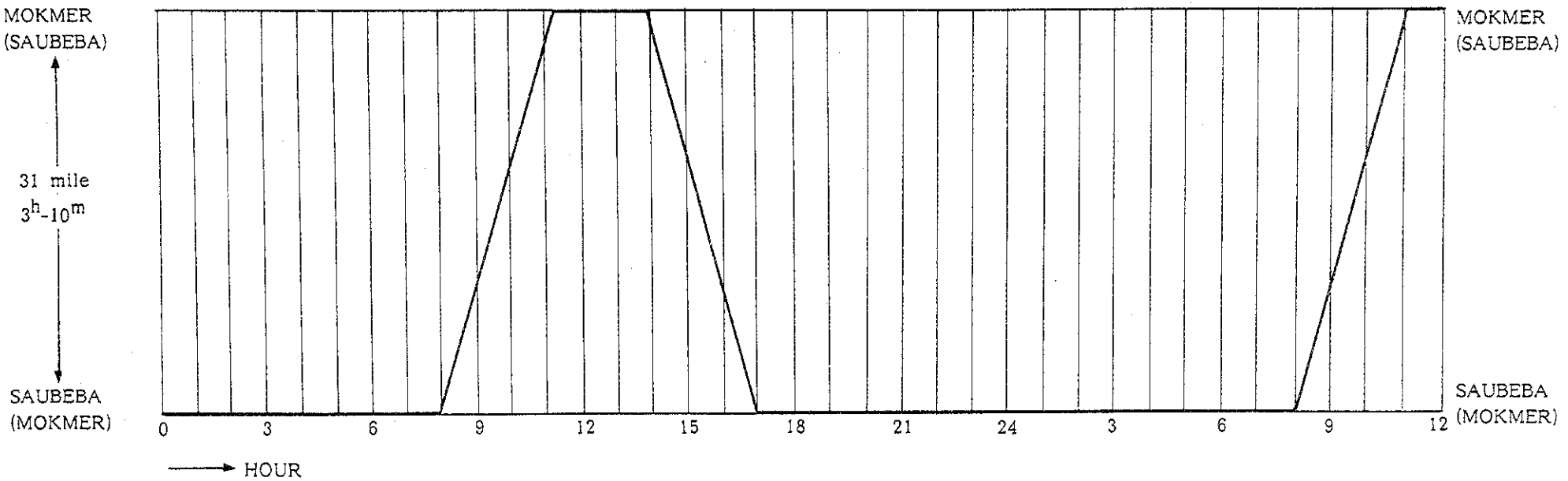


Fig. 4-1 TIME TABLE OF ROUTE 2-1

MOKMER (BIAK) ⟷ SAUBEBA (YAPEN)

- DISTANCE/TIME REQUIRED
  - LEWOLEBA - TERONG : 17 MILE/1^{h}-50^{m}
  - TERONG - LARANTUKA : 14 MILE/1^{h}-40^{m}
- VESSEL : 300 GRT, 11^{kt}
- SERVICE FREQUENCY : ONE ROUND TRIP/DAY

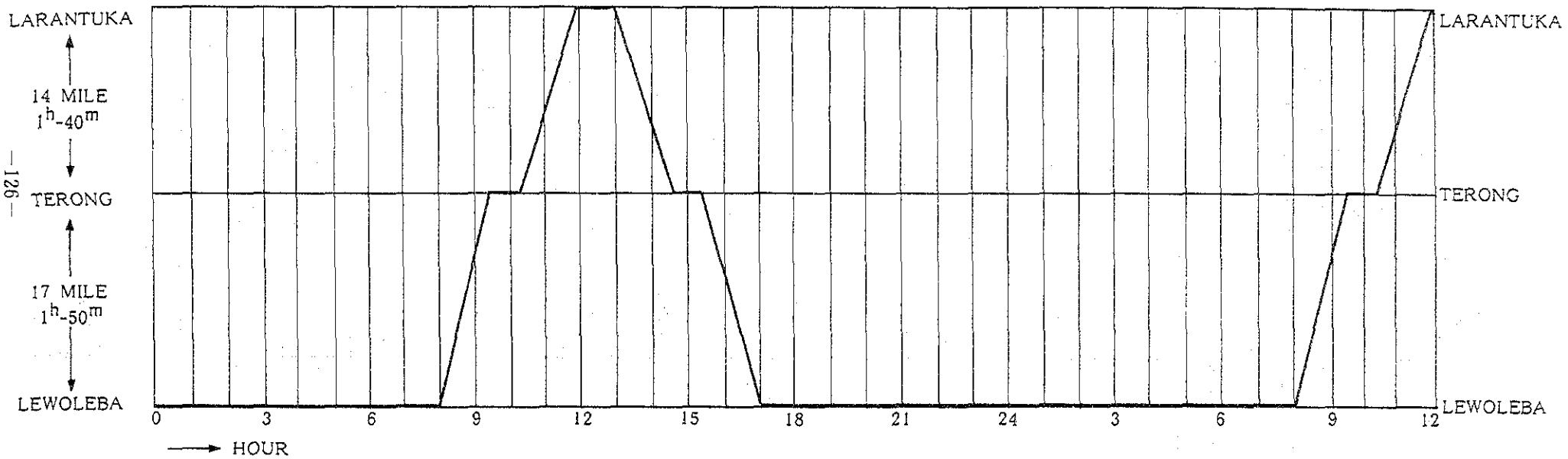


Fig. 4-2 TIME TABLE OF ROUTE 3-1

LARANTUKA (FLORES) ⟷ TERONG (ADONARA) ⟷ LEWOLEBA (LOMBLEN)

DISTANCE	: 80 MILE
TIME REQUIRED	: 8^h by 5 EXISTING VESSELS 5^h - 30^m BY "A" VESSEL
VESSEL	: 5 EXISTING VESSELS AND ONE ADDITIONAL "A" (1,000 GRT, 16 kt)
SERVICE FREQUENCY	: 2.5 ROUND TRIPS/DAY BY 5 V. ONE ROUND TRIP/DAY BY "A"

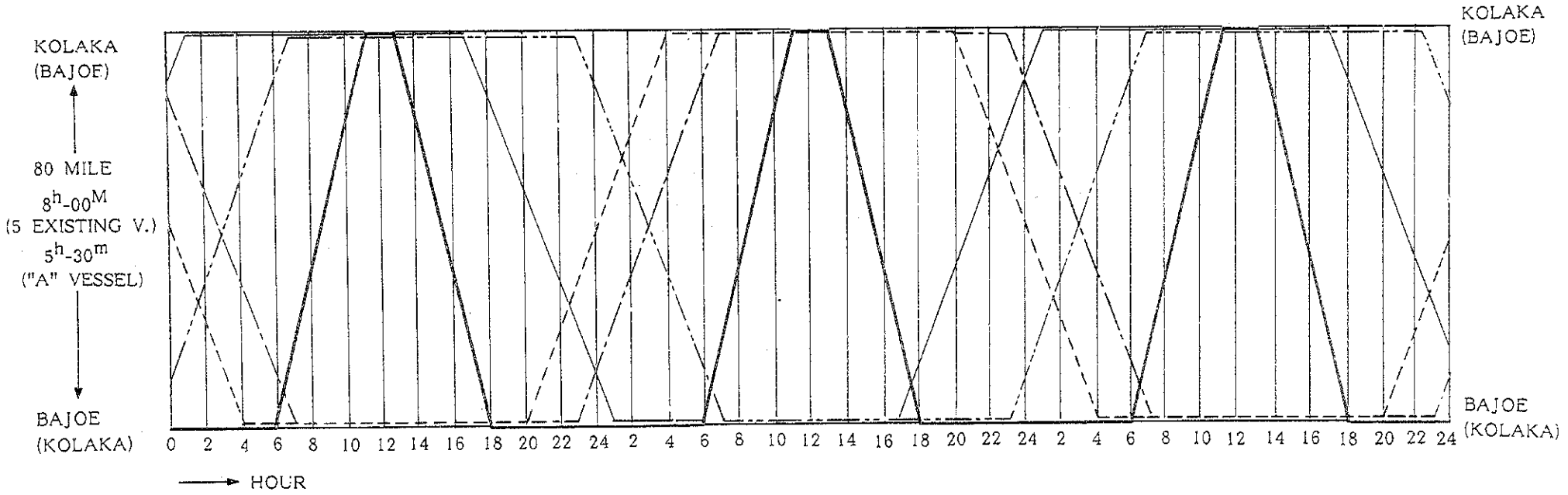


Fig. 4-3 TIME TABLE OF ROUTE 8

BAJOE ⟷ KOLAKA

DISTANCE	: 74'
TIME REQUIRED	: 8^h - 00^m (2 EXISTING V.) 6^h - 30^m ("B")
VESSEL	: 2 EXISTING VESSELS AND ONE ADDITIONAL "B" (500 GRT, 14 kt)
SERVICE FREQUENCY	: 2 ROUND TRIPS

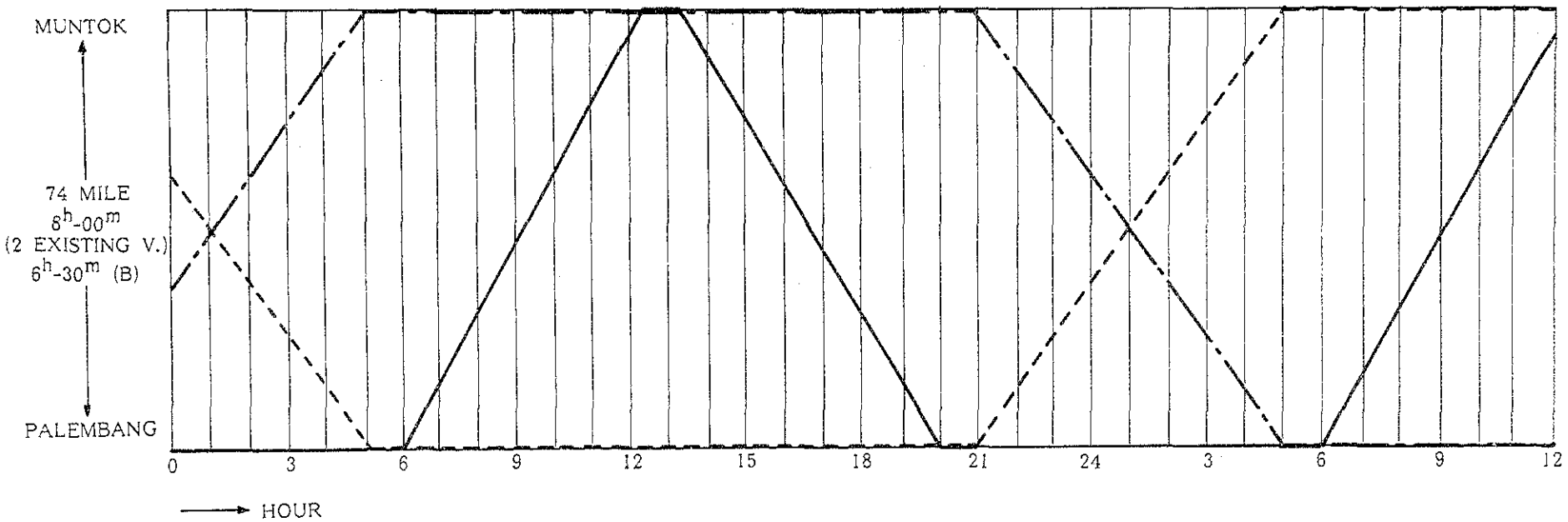


Fig. 4-4 TIME TABLE OF ROUTE 9-1

PALEMBANG ⟷ MUNTOK (BANGKA)

Table-4-1 List of New Navigational Aids

No. Name (Place)	Type of Mark	Light Color/Rhythm	Position Lat.(S) Long.(E)	Remark
(The Mokmer Saubeba route)				
Light Beacon				
1. Mokmer A	Leading L't	Fl.3s.	01-11-54 136-08-55	rough p'n
2. Mokmer B	Leading L't	Fl.3s.	backward of the above	
3. Saubeba A	Leading L't	Fl.3s.	01-41-00 136-17-30	rough p'n
4. Saubeba B	Leading L't	Fl.3s.	backward of the above	
5. Saubeba W.BW.	Star'd L't	F.(G)	end of the West B.W.	
6. Saubeba E.BW.	Port L't	F.(R)	end of the East B.W.	
Light Buoy				
1. Off Mokmer	Star'd	Fl.(G)	W end of the 1.9m kr.	Chart191
2. Off Mokmer	Port	Fl.(R)	E end of the 0.9m kr.	--do--
(The Larantuka - Terong - Lewoleba route)				
Light Beacon				
1. Larantuka A	Leading L't	Fl.3s.	08-20-50 122-57-10	rough p'n
2. Larantuka B	Leading L't	Fl.3s.	backward of the above	
3. Terong A	Leading L't	Fl.3s.	08-22-30 123-24-36	rough p'n
4. Terong B	Leading L't	Fl.3s.	backward of the above	
5. Lewoleba A	Leading L't	Fl.3s.	08-23-36 123-06-36	rough p'n
6. Lewoleba B	Leading L't	Fl.3s.	backward of the above	
(The Bajoe - Kolaka route)				
Light Beacon				
1. Bajoe A	Leading L't	Fl.3s.	04-32-40 120-25-20	rough p'n
2. Bajoe B	Leading L't	Fl.3s.	backward of the above	
3. Kr.Totopala W	Cardinal L't	VQ(9)10s.	West end of Kr.Totopala	
4. Kolaka A	Leading L't	Fl.3s.	on the new jetty	
5. Kolaka B	Leading L't	Fl.3s.	backward of the above	
6. Kr.Padamarang	Lateral L't	Fl.(R)6s.	04-03-20 121-23-48	
7. Kr.Rosa Marie	Isolated danger	Iso.10s	04-05-30 121-08-50	
Light Buoy				
1. Off 750m Kr.	Lateral L't P	Fl.(R)3s.	750m SE off jetty end	Bajoe
2. Off 1250m Kr.	Lateral L't S	Fl.(G)2s.	1250m NE off jetty end	-do-
3. Off 2000m Kr.	Lateral L't S	Fl.(G)4s.	2000m ENE off jetty end	-do-
4. Off 6000m Kr.	Lateral L'T S	Fl.(G)6s.	West end of Kr.Torea	-do-
(The Palembang - Muntok route)				
Light Beacon				
1. Muntok A	Leading L'T	Fl.3s.	02-04-54 105-08-07	rough p'n
2. Muntok B	Leading L't	Fl.3s.	backward of the above	
Light Buoy				
1. Kr.Haji S	Lateral L't S	Fl.(G)3s.	S passage of Kr.Haji	
2. Kr.Haji P	Lateral L't P	Fl.(R)3s.		