The trough of low pressure moves slowly N across the areas between February and July and then returns S during the remaining part of the year. The pressure reading tend to become more uniform over the intervening months and the location of the trough is not defined.

Day to day variations are small over most of the area, but changes are more marked towards 10°S. The pressure will rise above the average when the anticyclone W of Australia intensifies; a sharp fall of pressure in these S parts may be associated with the passage of tropical storm from the Timor Sea to the South Indian Ocean.

32. **Tropical Revolving Storms.** On rare occasions a tropical revolving storm may pass on a SW track near the extreme S of the area covered by this paragraph.

33. **Fronts.** The familiar weather changes which occur at frontal boundaries in temperate latitude are not experienced in this tropical area. Convergence zones, which are similar in some respects to the front of higher latitude, result from the meeting of the two main air streams of the N and S hemispheres, and are known as the **Inter-tropical Convergence Zone(ITCZ)** or sometimes called the **Inter-tropical front,** which separates the NW monsoon from the SE monsoon. This convergence belt runs roughly E to W with considerable variations in width. It lies approximately along latitude 7°S in January, then move slowly N over the area covered by this chapter during February to April followed by the SE monsoon. It continues to move N over the South China Sea during May and June to about 5°N. The ITCZ later moves S and crosses the area during November to December to reach its S limit at latitude 7°S, again in January; the NW monsoon then dominates the whole region.

The boundaries of the ITCZ are marked by heavy cumulonimbus clouds and increasing frequency of rain squalls and thunderstorms. The degree of activity varies a great deal along the convergence line and the change over may not be easily recognized in some sections.

The mean position of ITCZ is indicated on Fig. 4-1-11(2) and (4)A. Transient convergence zones or squally-lines occasionally develop within both monsoons and they intensify the tendency for heavy showers and thunderstorms for a time.

34. **Winds.** The normal seasonal distribution of winds over the sea area is given in Fig. 4-1-11(1), (2), (3) and (4)A.

During the NW monsoon, the wind is mainly N over the sector nearest the equator and veers to NE over the South China Sea, but farther S the wind tends to go back towards W. In the SE monsoon the prevailing wind is from between E and SE over the higher S latitudes, SE to S towards Singapore and becoming S to SW over the South China Sea.

The NW monsoon prevails from November to March, and the SE monsoon is established over the whole region from April to September.

The average wind strength is about the same in both monsoons, ranging from force one to force four; while light variable winds prevail during transitional period. There are spells when the SE monsoon exceeds force four; and a moderate swell develops to S of Sunda Strait. This occurs when the anticyclone off West Australia intensifies. There are also brief periods when the NW monsoon increases to force five.

35. **Gales.** The frequency of gales at all times of the year is low over the whole area. Percentages, frequency of reports from ship observations are given in Fig. 4-1-12(1) and (2)A. Gale reports in other months are similar or rather less. Gale force winds are most likely to occur in the S part of the area when tropical storms which develop over the Timor Sea move on a track somewhat closer to Christmas Island(10°25'S, 105°43'E) than usual. A similar effect may develop in the extreme N of the area when typhoon from the Philippine travel closer than usual to North Borneo.

Sudden gusts, which occur in rain squall and squalls from steep hills near the coast may also reach gale force.

36. **Local Coastal Winds.** The variations which are encountered in the various sectors of the area covered by this paragraph will be found in the relevant paragraph of **local weather, current and tidal streams.**

Land and sea breeze are major factors in controlling the speed and direction of coastal winds. Onshore winds are increased considerably by the sea breeze during the afternoon, while off shore winds at night are strengthened by the land breeze component. Intermediate wind directions are deflected by these diurnal effects.

Topography in the locality, such as high ground and irregular coastline also cause significant deviations.

37. **Fog and Visibility.** Visibility is usually good and fog is rare. Patches of

radiation fog form on land towards dawn, but these clear soon after sunrise; some marshy estuaries of West Borneo and East Sumatera are likely area. Most reports of poor visibility are associated with heavy rainstorms, sometimes below the fog limits. Visibility is often excellent in the NW monsoon.

There is considerable haze at times during the SE monsoon and outline of mountains become indistinct; the usual blue sky turns white or grayish colour. The haze becomes worse during the end of the season, especially following a drought over NW Australia. The visibility during this period is reduced to five to ten miles, and may fall to one mile at times with a S breeze near Jakarta. The thicker haze is known locally as **Tengarra Putik** or **White Southeaster.**

38. **Sea and Swell.** Sea disturbance and swell are mainly slight for most of the area throughout the year. Severe squalls sometimes create unpleasant conditions and the hazard is increased if the sudden rise of wind and sea occurs in restricted waters.

The E to SE trade wind produces a moderate swell at times over the extreme S of the area. Sea and swell may rise considerably after a prolonged increase in these regular winds. A small percentage of moderate N swell is reported in the area between Sumatera and Borneo during December to February. This effect is most marked to N of the equator during the persistent NE monsoon of the South China Sea. Similarly, the S half of this area reports about 5% of moderate SE swell following a spell of increased SE winds.

Estuaries exposed to these seasonal winds often experience a troublesome surf.

39. **Local Weather, Currents and Tidal Streams.**

Local weather features in Selat Bangka. In Selat 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 with the greater activity at night. Appreciable seas occur when fresh winds oppose the tidal streams.

Currents and Tidal Streams in Selat Bangka. From November to April the current sets SE through the strait at a rate of **up to one knot.** The SE set persists on the Sumatera side of the strait throughout of the SE monsoon, but at the height of this monsoon, in July, a NW set of up to a quarter knot prevails off the Bangka coast up to and beyond Gosong Amelia and Gosong Nemesis. In other months the currents off the Bangka coast are light and variable.

The tidal streams flow into Selat Bangka from both ends, meeting in the neighbourhood of Kepulauan Nangka. There is usually only one strong in-going stream a day and two weaker, out-going streams separated by a slack period. Daily predictions of the stream at the two ends of the strait are made, as below.

Tide-rips are frequently found abreast Kepulauan Nangka during the SE monsoon, and are probably due to the meeting of the current setting SE along the Sumatera shore in the N part of the strait with the current setting NW along the Bangka shore in the S part of the strait.

In the S approaches to Selat Bangka there is sometimes a S-going flow for days on end, with a maximum rate of **two and a quarter knots** at the height of the NW monsoon. At other times the weak N-going flow lasts only for a maximum period of four hours and reaches a maximum of only a half knot, the flow being S for the rest of the day. It thus appears that during the NW monsoon there is a S current of **one to one and a half knots.**

The tidal streams off Gosong Nemesis and off Gosong Amelia are predicted in **TIDAL STREAM TABLE of HIDRO-OSEANOGRAFI**, and give times and strength of maximum rate in either direction, and the times of turn.

The horizontal water movement at both these banks is the resultant of the tidal stream and predominating S current referred to above. This current and the maximum rate of flow which can be expected (tidal streams and currents) are as follows:

Gosong Nemesis

Month	Predominating current			Maximum rate		
January	SE	1	knot	SE	2 1/2	knot
February	SE	3/4		SE	2 1/2	
March	SE	1/2				
April	SE	1/4				
May						
June				NW	2	
July	NW	1/4		NW	2	
August						
September						
October	SE	1/4				
November	SE	1/2				
December	SE	3/4		SE	2 1/2	
		Gosong Amelia				
January	ESE	1		ESE	2	
February	ESE	3/4		ESE	2	
March	ESE	1/2		ESE	2	
April	ESE	1/4				
May						
June						
July	WNW	1/4		WNW	1 1/4	
August						
September						
October	ESE	1/4				
November	ESE	1/2		ESE	2	
December	ESE	3/4		ESE	2	

Tidal Streams in Air Musi are of a mixed character, sometimes semi-diurnal, but frequently diurnal; there is, however, insufficient information to give an accurate description. The average rate of the ebb stream is usually two knots and that of the flood stream from one to one and a half knots; slack water is of short duration. The flood stream is frequently felt as far up as Palembang, and vessels lying off the town usually swing a half hour after high or low water by the shore; the surface water changes direction first so that shallow draught vessels swing before those of deep draught. If little rain falls in the interior there are sometimes two tides a day, although this is exceptional as the town lies too far from the mouth of the river. During the rainy season, from November to March, there is sometimes no flood stream at Palembang for days at a time.

Local Weather Feature in Selat Gelasa. In Selat Gelasa, light variable winds prevail in April and November. The SE monsoon operates from May to October and the NW monsoon from December to March. WNW winds predominate in December veering to NW in January with increasing force and consistency and persisting to March.

Squalls are most frequent in November and December. A moderate swell develops during NW monsoon in January to February.

Currents and Tidal Streams in Selat Gelasa. The currents in Selat Gelasa set SE in the NW monsoon. There is little information on rates, but it is probable that the currents occasionally exceed three knots in some of the narrow passages. The tidal streams are strong in Selat Leplia and Selat Limendo but their directions are somewhat difficult to foretell. The same applies to Selat Baur, except for the following particulars obtained near Pulau Langkuas(2°32'S,107°37'E):-The directions of the tidal streams perform a complete circle, clockwise, in 24 hours. The maximum rate always occur twice each day, when the streams run either in a NNE or a SSW direction; the streams which run ESE or WNW are about half this rate.

Currents and Tidal Streams in NE side of Pulau Bangka. Along the outer edge of the reef and in the open sea off the NE coast of Pulau Bangka, the streams are largely non-tidal, being caused by the wind-drift, and consequently no reliance can be placed on a position obtained by dead reckoning. Off Tg.Belikat the monsoon current may attain a considerable rate.

Tidal Streams in Pangkalbalam. Tidal streams in the river are semidiurnal.

Current and Tidal Streams around Pulau Belitung. The horizontal movement of the water close to the coasts of Pulau Belitung is a diurnal tidal stream, whilst farther off the E coast, in the fairway of Karimata Strait, it is mainly monsoon current. In the narrow passage between islets and reefs the tidal stream plus current may attain a rate of from two to three knots.

The directions in which the streams set are as follows:

Locality	Direction
Off the S coast	W and E to SE
Off the N coast	W to WNW and E to SE

4-2 Setting up the Model Type of Ferryboat

40. **The Existing Ferry Fleet.**

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.

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

Table 4-2-1 A classified table of ferryboats by type

GRT		No.	%
from	to		
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 4-2-2 A classified table of ferryboats by age

Year Built		Age	No.	%
from	to			
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

41. **Advantage of Setting up the Model Type of Ferryboat**

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 Table 4-2-2 shows, a certain number of overage vessels should be replaced by new ones year by year to maintain safe and up-dated operation.

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.

42. **The Five Model Types of Ferryboat in the Proposed Routes**

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.

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.

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.

Table 4-2-3A 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).

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.

4-3 Allocation of Desired Types of Ferryboat in Proposed Routes

43. **Criteria for the Allocation.**

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

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. Table 4-3-1A shows the desired type of vessel for each route which ensure her seaworthiness throughout the service under the given natural conditions.

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 4-3-1A, independently from that of the natural conditions.

44. **Allocation of the Optimum Type of Vessel**

From the abovementioned two factors, the conclusion has been derived to allocate a larger type of vessel as far as it is practical.

Table 4-3-1A shows the summary of captioned matter with remarks relevant to the local natural characteristics.

4-4 Planning of Ferry Operation

45. **Loading Capacity of Cars on Each Type of Vessel**

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

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

  $A = 0.7 \times L \times B$

  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 of a ferryboat are assumed according to

the Japanese standard, as

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

46. **Method for Estimating Required Service Frequency in the Routes**

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 (See table of par.45)

In addition to this, the transport of cars other than trucks should be included.

From these accounts, the results of required frequency of service trip for cars are shown in Table 4-4-1.

* 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(See Table 4-2-3A)

47. **A Plan for Ferry Trip Service Schedule in the nine Proposed Routes**

A ferry trip service schedule on the nine proposed routes derived from par. 45. and 46. is shown in Table 4-4-1 on the next page.

And, in connection to the above, a model for the "Time Table of Ferry Service" on each route is shown in Fig. 4-4-1A to 4-4-9A.

Table 4-4-1 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 Vessel Type	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'/01-30	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 (0.4)	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

Chapter 5 Ferry Terminal Development Plans

5-1 General

1. To determine the ferry terminal sites for the proposed nine routes, field surveys were conducted, and sea conditions(water depth, waves, tide and current) and land use condition were investigated at the 47 candidate terminal sites; finally 25 terminal sites were selected for the study. Most of the terminals determined 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(Route 2), Pulemo(Route 4) and Muntok(Route 9).

(1) Land for Terminal

2. The land for the construction of a new terminal will be prepared by reclamation or by readjustment of natural beach neighboring to the planned mooring facilities ; in principle the latter will be considered appropriate for application in this study. However, in the following terminal sites, it will be difficult to construct a terminal on 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. It is of a prime importance to consider preservation of sea environmental resources in the selection of development sites, type of facilities and construction work.

(2) Mooring Facilities

Types of Rolling-on Systems

4. 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. In case that the tidal range is large, movable bridge type or pontoon type is convenient for smooth rolling-on and rolling-off of vehicles. From the view point of the maintenance costs, the fixed type is recommended where the tidal range is comparatively small. Simple calculation for the fixed type shows that tidal range should approximately be less than 1.5m for smooth embarking/ disembarking of vehicles. The tidal range in the eastern part of Indonesia is relatively small; for example, the tidal range at Biak is 1.6m. At the other terminal sites in the eastern part, however the tidal ranges are approximately 1.6 to 3.0m. The tidal range at Palembang ferry terminal in Musi River is nearly 3.7m; at Sadai of Bangka island and Tg. Barong of Belitung island, it is nearly 2.8m.(pontoon types are installed at Palembang and Kayu Arang ferry terminals.) The type of rolling-on system at Bajoe and Kolaka is now fixed type. As mentioned in the section 2-8-2 of Part I, the ferry service is now operated by using five boats(500GRT and 1000 GRT) and many large-scale trucks are loaded; in these circumstances, installation of the movable bridge type is requested by many truck drivers for smooth embarkation.

5. Many fixed types of rolling-on system in the eastern part of the nation have already been replaced or will be replaced with other types. 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.

Water Depth of Berth

6. According to TECHNICAL STANDARD FOR PORT AND HARBOR FACILITIES IN JAPAN, water depth of ferry berth is generally designed using the following criteria.

Table 5-1-1 Water Depth of Berth of Ferry Boat Terminal

Size of Ship (gross tonnage)	Full Load Draft (m)	Water Depth of Berth (m)
1,000	4.0	5.0
2,000	4.3	6.0
4,000	5.0	6.5
10,000	5.3	8.0

7. In this study, the adopted maximum size of ferry boat is 1,000GRT, which is to be introduced on Bajoe-Kolaka route. According to the above Table, the clearance between the keel of the ferry and sea bottom of the berth(UKC) should be 1.0m. At Bajoe ferry port, sedimentation has continued and water depth around the mooring facilities is about 3.5m, which is smaller than the full load draft of 1000GRT-ferry boat, thus dredging is now required. On the other hand, the extension of the length of existing 2.7km-jetty, which will be required to accommodate 1000GRT ferry boat, should be minimized. For this reason the minimum value of UKC of 0.5m is used in this study.

(3) Others

8. To provide a comfortable environment to the passengers using a ferry terminal and residents living in the neighborhood, it is recommended to prepare parks, green zones etc. in the terminal area.

5-2 Ferry Terminal Development Plans on Each Route

5-2-1 Ambon - Seram Route

9. As mentioned in Part-1, this ferry route connects the two islands through the terminals of Hunimua and Waipirit. According to the demand forecast of cargo/passengers on this route, about 33,000tons of cargoes and 1,100,000 passengers will be transported in 2010 which are 5.4 times and 3.7 times larger than those in 1990 respectively. The two ferry boats now in operation are about 150 and 200GRT-class and the frequency of ferry operation is six rounds a day. This ferry route is used for daily activities(that is, shopping,business, visiting the relatives, attending to school and etc.); this requires high frequency of operation in day time. To cope with the increase of cargoes/passengers and maintain a high service level(the frequency of ferry operation), two 500GRT-class ferry boats should be introduced and the frequency of operation should be six rounds a day, the same as it is now.

10. The existing mooring facilities at Hunimua terminal seem to have a sufficient water depth for the berthing of 500GRT-class ferry boat although some reinforcements are required to the mooring dolphins and the breasting

dolphins. (See Page 134 of Appendixes Part 1) 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 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 mentioned above.

11. Remarkable littoral drift has continued in the sea area around the existing mooring facilities/jetty at Waipirit ferry terminal, which results in the accumulation of sand in the sea area to the east of the jetty, and erosion in the sea area to the west.(See Page 135 of Appendixes, Part 1) And also the water depth in front of the mooring facilities is becoming shallower and is now 2-3m. Dredging here is planned.
To introduce 500GRT ferry boats here, it is necessary to extend the existing jetty in the southwestward as far as the point of 3.5m water depth A movable bridge type is to be installed here.

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

12. The new ferry route between Biak and Yapen is planned to have terminals at Mokmer and at Saubeba. The forecasted demand of cargo/passengers requires two-round trips a day in 2010, which will be performed by operating a 300GRT-class ferry boat; its speed should be more than 14 knots for the daytime operation as mentioned in Chapter 4.

13. Although a new terminal site at Mokmer is protected from southeasterly waves by the islands in front of Mokmer, it is necessary to protect a new Mokmer port from southwesterly waves by constructing a breakwater.(See Page 137 of Appendixes of Part 1)

14. In the sea area to the north of Yapen island, the predominant wind direction is north-east and a strong westerly wind sometimes blows from November to March. A new terminal at Saubeba is protected considerably from westerly and easterly waves by neighboring shoals, but it is necessary to protect

more the berthing area by the extension of breakwaters on the shoals mentioned above. The land for terminal facilities should be prepared by readjustment of the land behind the beach.(See Page 139 of Appendixes of Part 1) A road to the terminal site from Serui, the largest city in this island, is now under construction, which is indispensable not only for the development of this Biak-Yapen route but also for the development of Yapen-Irian Jaya route. This road will be helpful to connect Irian Jaya with Biak city, the largest city in this region by ferry route.

15. The new ferry route between Yapen and Irian Jaya will have terminals at Kabuaena and Kimi. The forecasted demand of cargo/passengers requires one-round trip per day by a 300GRT ferry boat with the operation planned at night. 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.(See Page 141 of Appendixes,Part 1)

16. There are about ten residences and a church at Kimi, thus the land for terminal facilities should be prepared apart from the residences and the church.(See Page 142 of Appendixes of Part 1) Two rivers that 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, for example applying a permeable type of structure for the jetty which will let littoral drift sand pass through it. An access road to Nabire of about 20km long is available although it is not paved over a length of 2km.

5-2-3 Flores - Alor Route

17. The Flores-Alor route connects the five islands, Flores, Adonara, Lomblen, Pantar and Alor. These also now exits a Larantuka-Waiwerang-Lewoleba route operated by a 233GRT ferry boat. According to the demand forecast, a 300GRT-class ferry boat should be introduced on the Flores-Adonara-Lomblen route and a 500GRT-class ferry boat on the Flores-Alor route calling at three islands of Adonara, Lomblem and Pantar.

18. 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.(See

Page 143 of Appendixes of Part 1) Therefore introducing 500GRT-class ferry boat on this route does not require any improvements to the existing mooring facilities and rolling-on system. The land for terminal facilities with the area of 100 by 100m has been prepared, which is enough for building the terminal facilities in 2010.

19. The new terminal site Terong is located 2.5km to the west of Waiwerang village, where there is a jetty used by traditional passenger boats and ferry boats. The land for terminal here is planned to be prepared by readjustment of the natural land located between the beach and the road leading to Waiwerang.(See Page 145 of Appendixes of Part 1). The jetty and mooring facilities of a sea port exist close to the planned site. 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.

20. The land for the terminal at Lewoleba has been reserved by the local government. A ferry terminal will be constructed between the beach and the road leading to the center of Lewoleba. (See Page 148 of Appendixes of Part 1) The new jetty leading to the mooring facilities on the tip is 20m long.

21. The ferry terminal at Baranusa is planned on the beach in the small branched bay in Blangmerang Bay, apart from the residential zone.(See Page 151 of Appendixes of Part 1) At the mouth of the small branched bay, a new sea port is being constructed by DGSC. Therefore, ferry terminal site and the approach channel should be properly selected so as not to have an undesirable influence on the sea port activities.

22. The existing ferry route connecting Kalabahi with Kupang is now using the mooring facilities in the sea port and is transporting only passengers. A new terminal plan for ferry service has been made and the reclamation has already started.(See Page 152 of Appendixes of Part 1) The area now being reclaimed is too small to accommodate the terminal facilities required in 2010. According to the DGLT's plan, the required land is prepared behind the beach. An existing road is available for access from the center of Kalabahi.

5-2-4 Southeast Sulawesi - West Kabaena Route

23. The terminal site on the main island side of Southeast Sulawesi is selected at Pulemo near Banbaea village because of its favorable sea conditions, a reef with a length of 500m protects the inner sea area from waves and also the inner sea area has a sufficient water depth for navigation of ferry boats to be introduced there.(See Page 155 of Appendixes of Part 1) The interview survey conducted in February, 1992 reveals that sometimes westerly waves invade into the area though the frequency of occurrence of this wave direction is not clear now. Therefore, the mooring facilities are designed without breakwaters although a further detailed investigation will be required.

24. There exists a jetty there which is used by 300GRT-class conventional vessels. The access to that point by a planned 300GRT-class ferry boat seems to be possible but a detailed topographical survey is necessary to determine the access channel. The access road from Banbaea village to the terminal site is not paved and the bridge on the route remains non-repaired, thus its improvement is urgently required. Further study will be required on the necessity of a new road connecting directly with the existing main road which passes through the northern part of Pulemo leading to Kolaka.

25. The land for the terminal at Sikeli of Kabaena island is planned to be prepared by reclamation.(See Page 156 of Appendixes of Part 1) Interview survey suggested another alternative to prepare a part of the terminal just behind the beach to provide an area, for example, for a parking lot for passengers' vehicles.

26. In this study, the Study team assume that in 2010, the two routes of Southeast Sulawesi-West Kabaena and East Kabaena-Muna will be put in operation. If only one route is to be operated, the demand of passenger/cargo traffic on one route will almost be doubled and then the frequency of service should be increased accordingly. Even then, the planned size of the terminal will sufficiently meet the increased demand. The road connecting west Kabaena with east Kabaena is under construction, and will increase the vehicles/cargoes movement between the two regions when completed.

5-2-5 East Kabaena - Muna Route

27. The land for Dongkala terminal in Kabaena island is planned to be prepared by reclamation because a number of residences occupy the beach area around the planned site.(See Page 159 of Appendixes of Part 1) The sea area in the north of the existing jetty is now occupied by a lot of beach houses, thus the reclamation is planned in the sea area to the south of the jetty. 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. If the mooring facilities are planned further southward, it will be required to provide a breakwater to protect the facilities from southerly waves.

28. The slope of sea bottom in front of Mawasangka in Muna island is fairly gentle, then the mooring facilities are required to be built at a point 900m off the beach, by extending the length of the existing jetty by 400m.(See Page 160 of Appendixes of Part 1) Detailed surveys should be conducted on sea bottom topography to find out a proper access channel to the mooring facilities.

5-2-6 Kendari - Wowonii Route

29. An area in the east of the existing jetty at Kendari is composed of sandy beach, and the sea area in front of the beach is now utilized by small canoes to carry passengers/cargoes from the beach to larger boats.(See Page 162 of Appendixes of Part 1) 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, therefore, will only be prepared by reclamation of a water area in the east of the existing jetty. With additional facilities such as steps, bits etc., the revetments for reclamation will be utilized by conventional canoes now engaging in nearby sea transportation service, if necessary.

5-2-7 Morotai - Halmahera Route

30. The new ferry route between Morotai-Halmahera is planned to have terminals at Daruba and Gorua. The land for ferry terminal at Gorua will be prepared on the land behind the beach apart from the residences.(See Page 165

of Appendixes of Part 1) The access road with a length of 3-4km to Tobelo is paved and in good condition.

31. Because of the topographical conditions, terminal facilities at Daruba should be constructed on the readjusted high land behind the beach, the ground level of which is about ten meters.(See Page 166 of Appendixes of Part 1) There are no residences around here. The existing road is available for access from the center of Daruba.

5-2-8 South Sulawesi - Southeast Sulawesi Route

32. As mentioned in Part-1, this short-cut type ferry route connects the two provinces with the two terminals at the end of the route, Bajoe and Kolaka. Because of the shallowness of Bone bay, especially on Bajoe side, conventional sea transportation has not developed fully and lots of cargoes are transported by ferry boats between the province of South Sulawesi through Ujung Pandang and Bajoe, and the province of Southeast Sulawesi through Kendari and Kolaka. According to the demand forecast of cargo/passengers on this route, about 205,000 tons of cargo and 1,100,000 passengers will be transported in 2010, which are about 1.9 times and 3.6 times larger than those in 1990.

33. 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, 1000GRT-class ferry boats are planned to be introduced, which requires the construction of a mooring facilities at a point at least 4.0m deep. (See Page 168 of Appendixes of Part 1) Consequently, the existing 2.7km-long jetty will have to be extended by about 300m. New mooring facilities should be constructed a little apart from the existing mooring facilities to make it possible to provide continuous ferry service using the existing facilities even during the period of the construction of the new facilities.

34. In Bajoe terminal, there is a parking lot with an area of 1750 m^2, the capacity of which seems to be enough for parking vehicles embarking on a 1000 GRT ferry boat.(See Page 167 of Appendixes of Part 1) But when three ferry boats leave from the same terminal in one night at a short time interval, the existing parking area is so small that it is necessary to expand it(the room for

the expansion can be found around the existing parking lot). A parking area for vehicles to transport passengers between the terminal and city/town area is also required; the 2.7km-jetty is too long for passengers to walk through from the existing parking lot to the mooring facilities. 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.

35. In Kolaka terminal, there is not a parking lot exclusively used for vehicles embarking on a ferry boat, then a new parking lot is planned to be constructed on the beach area to the west of the existing terminal by reclamation.(See Page 169 of Appendixes of Part 1) Since its ground level is somewhat higher than the chart datum level, the construction cost for reclamation seems to be considerably low.

36. The water depth around the mooring facilities at Kolaka is not shallow, thus it is not necessary to extend the existing jetty so much.(See Page 170 of Appendixes of Part 1)

37. New mooring facilities to be installed on both sides of the route should be movable bridge type to ensure the smooth and safe rolling-on of large-scale truck and heavy movable-type construction machineries through the ship ramp. Some respondents to the interview survey conducted in February,1991 requested the improvement of the access road on the 3km long jetty, and it will become more important as the volume of transportation of passengers /cargo increases.

5-2-9 South Sumatra - Bangka Route

38. The existing route here connects Palembang and Kayu Arang. Because of the shallowness at the mouth of Jering River, it is difficult to pass through the mouth to go to Kayu Arang terminal at the tide of low water level and therefore, the destination on Bangka island side has often temporally been changed to Muntok port.

39. According to the demand forecast of cargo/passengers on this route, about 40,000 tons of cargo and 320,000 persons will be transported in 2010, which are about 16 times and 3.9 times larger than those in 1990 respectively. The sizes of ferry boats operated here are small size type of 150 - 200 GRT. To cope with

the increase of cargo and passenger traffic, larger-size ferry boats as large as 500-class are planned to be introduced.

40. A new terminal site on Bangka island side is located to the west of Muntok port and will not be affected by the influence of sedimentation as described in Part 1.The slope of the shore is not so gentle and it is rather easy to introduce larger ferry boats.(See Page 173 of Appendixes of Part 1) The new terminal site is protected from westerly waves by a cape, but the safe mooring of ferry boat requires maximum protection from southeasterly waves. The land behind the beach where a new terminal is to be constructed is flat and construction work of the terminal seems to be comparatively easy.

41. The distance on the sea to Palembang and the distance by road to Pankal Pinang from the two terminals Kayu Arang and Muntok are as follows

	Palembang	Pankal Pinang
Kayu Arang	190 km	80 km
Muntok	135 km	140 km

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.

42. At the existing ferry terminal in Palembang, the water depth in front of the mooring facilities is more than 5m and is sufficient to accommodate ferry boats of larger than 500GRT.(See Page 171 of Appendixes of Part 1). According to the increase of demand of cargo/passengers and the consequent enlargement of ferry boat size, parking lot, passenger terminal etc. should also be expanded. In that case, all the facilities should newly be designed to give the integrated layout to the terminal. The terminal is located at a distance of 20 minutes' drive from the center of Palembang by car and has good accessibility.

5-2-10 Bangka - Belitung Route

43. 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 1, then 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 sea areas around the proposed sites are protected from waves by islands and capes and will be very calm even without breakwaters.(See Page 178 and 181 of Appendixes of Part 1)

44. The distance between Pankal Pinang and Sadai is about 150km and road condition between Koba and Sadai is not good now, then the improvement of that portion of the road has been scheduled already. The improvement of road continues to provide good access to Tanjung Barong. Navigation route should pass through the sea area in the north of the island which is located in front of Sadai because of the existence of many shoals in the sea area in the southern part of the island.

Chapter 6 Ferry Terminal Standard Design

6-1 General

1. In this chapter, the standard designs of ferry terminals for the planned ferry boats are presented. The ferry terminal can be divided into two facilities from the design point of view, namely, the mooring facility and the on-land facility.

2. The capacity of the planned ferry boat for each terminal is determined by the demand of passengers and vehicles to be transported and is also determined by the maritime condition of the sea lane.

3. If the capacity of the ferry determined by the demand is bigger than that determined by the maritime condition, the mooring facility and on-land facility of the terminal are designed for the ferry determined by the demand.

4. On the other hand, if the capacity of the ferry determined by the maritime condition is bigger than that determined by the demand, the mooring facility should be designed for the ferry determined by the maritime condition. The on-land facility, however, is designed for the ferry determined by the demand.

6-2 Standard Dimensions of Ferry Boat

5. As explained in Chapter 4, it has been determined that four(4) kinds of ferry boats should be employed for objective nine (9) routes. The standard dimensions of the ferry boats have been determined as shown in Table 6-2-1 considering the dimensions of existing and planned ferries in Indonesia.

6. The correlation between dimensions and capacity (GT) of ferries in Indonesia is summarized and illustrated in Fig. 6-2-1A to Fig. 6-2-6A in Appendix Part 2.

7. From Fig. 6-2-3A, it is known that the drafts of Indonesian ferries are shallower than those of Japanese ferries because of different wave and wind condition.

Table 6-2-1 Standard Dimensions of Ferry Boat

Gross Tonnage (ton)	LOA (m)	B (m)	Full Loaded Draft (m)	Passengers	Vehicles 8t	Vehicles 4t
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

8. The boat sizes determined by the demand and maritime condition are shown for each route in Chapter 4.

9. Therefore, the planned ferry boats for the mooring facility and on-land facility of each terminal are as follows.

Table 6-3-1 Planned Maximum Size Ferry for Design

Route	Terminal Site	Planned Ferry for Mooring Facility (GT)	Planned Ferry for On-land Facility (GT)
1.	Hunimua-Waipirit	500	500
2-1	Mokmer-Soebeba-	300	300
2-2	Kabuaena-Kimi		
3.	Larantuka-Baranusa-Kalabahi	500	300
4.	Pulemo-Sikeli	300	150
5.	Dongkala-Mawasangka	150	150
6.	Kendari-Langara	150	150
7.	Gorua-Daruba	300	300
8.	Bajoe-Kolaka	1,000	1,000
9-1	Palembang-Muntuk	500	500
9-2	Sadai-Tj.Barong	300	300

6-4 Design of Mooring Facility

6-4-1 Length, Water Depth and Crown Height of Berth

10. The length of berth is the ship length (LOA) of the planned boat plus the distance to the mooring post of the stern line which should be at an angle between 30 degree to 45 degree to the face line of the berth.

11. The water depth of berth is determined by the fully loaded draft of the maximum size boat plus allowance for movement of the boat by wave action. Generally, this allowance is taken as 20% to 30% of the fully loaded draft. In this design, 50 cm of allowance for all boats is adopted considering the shallow coastal area of many of the proposed terminal sites.

Table 6-4-1 Water Depth of Berth

Planned Ferry Vessel (GT)	Water Depth (m)
150	-2.0
300	-2.7
500	-3.1
1,000	-4.0

12. The crown height of berth is determined by using 0.3m to 1.0m and 0.5m to 1.5m as height above H.W.L. for the tidal range of 3.0m or more and for the tidal range of less than 3.0m respectively.

13. From the view point of construction cost a low crown height is preferable. However, at locations affected by irregular high water, waves and subsidence, these conditions should be considered sufficiently to determine the crown height.

14. In this design, the following crown heights are recommended.

Table 6-4-2 Recommended Crown Height

Tidal 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

6-4-2 Breasting Dolphin

(1) Layout of Breasting Dolphins

15. The breasting dolphins should be arranged to accommodate the planned ferry boat safely in any loading condition and in any tidal condition. To satisfy the above conditions, breasting dolphins should be located in positions parallel with the hull of the ship and it is preferable that they are located as far apart from each other as possible. If only one type of ferry is operated for a route, two (2) breasting dolphins will be enough. However it is preferable that many types of ferries can be accommodated at a berth, except those boats larger than the planned boat. For this purpose three (3) breasting dolphins shall be provided at each berth as shown in Fig. 6-4-1.

(2) Fender System

16. In advance of the structural analysis of the breasting dolphin, the fender system should be designed.

17. The fender system should absorb the ship's berthing energy which can be calculated by considering the berthing method and the arrangement of fenders. In this design, a berthing velocity of 30cm/sec and an approaching angle of 10 degree are applied as the berthing method.

18. The tide variation and fully loaded or unloaded conditions should also be considered to determine the fender.

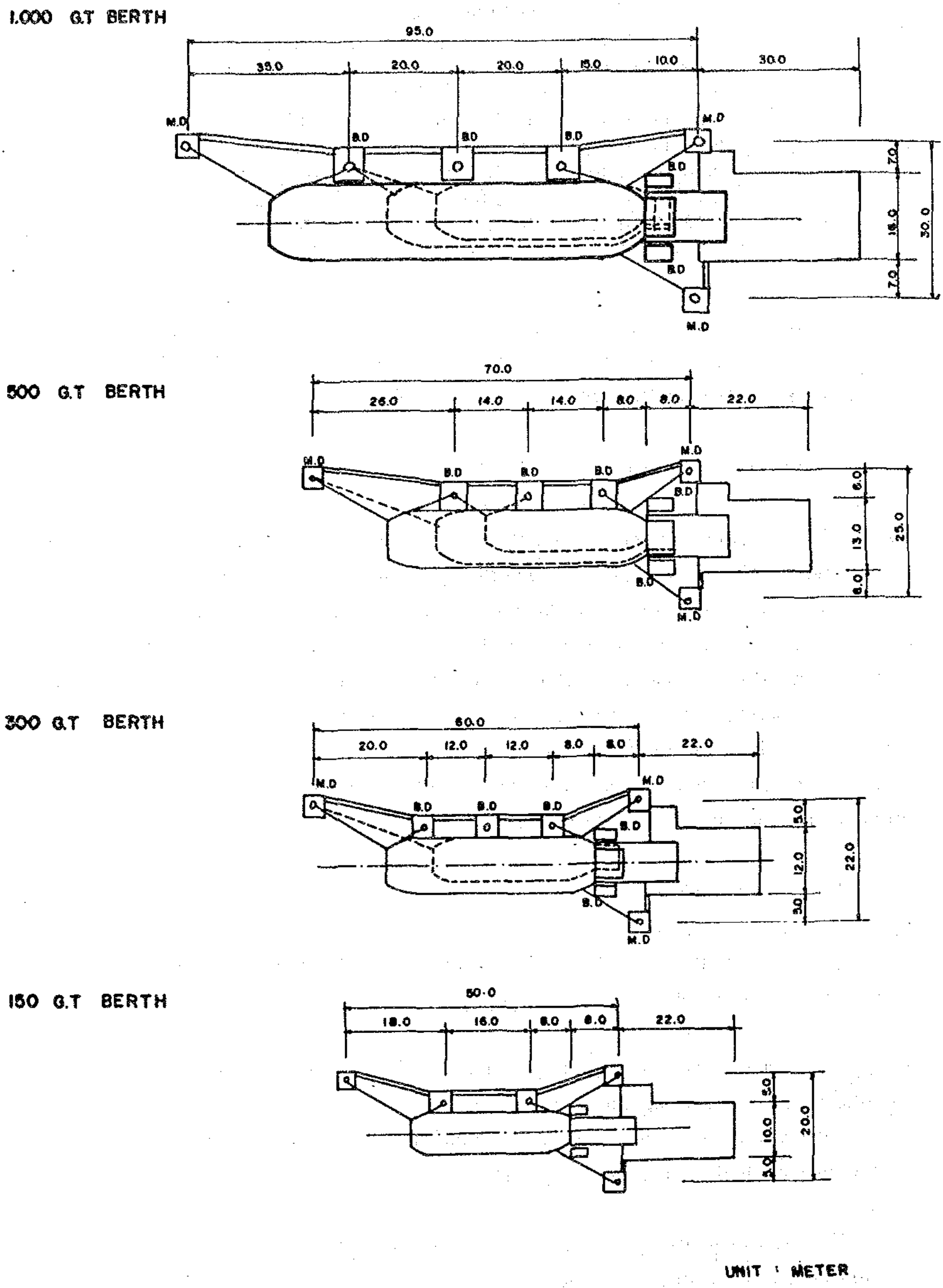


Fig.6-4-1 Layout of Mooring Facility

19. The recommended fender for each planned ferry is as follows;

Table 6-4-3 Recommendaed Fender

Planned Ferry (GT)	Berthing Velocity (cm/sec)	Approach Angle (degree)	Berthing Energy (ton)	Recommended Rubber Fender
150	30	10	0.59	V 300mm H 2.5m L
300	30	10	1.52	V 400mm H 2.5m L
500	30	10	2.40	C 500mm H, 3 units
1,000	30	10	5.92	C 630mm H, 3 units

(3) Structure of Dolphin

20. 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.
Typical cross sections of breasting dolphins are presented in Fig. 6-4-2.

6-4-3 Mooring Dolphin

(1) Layout of Mooring Posts

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

22. 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.

23. In addition to the above stern and bow lines, 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. The layout of mooring posts for each planned ferry is shown in Fig. 6-4-1.

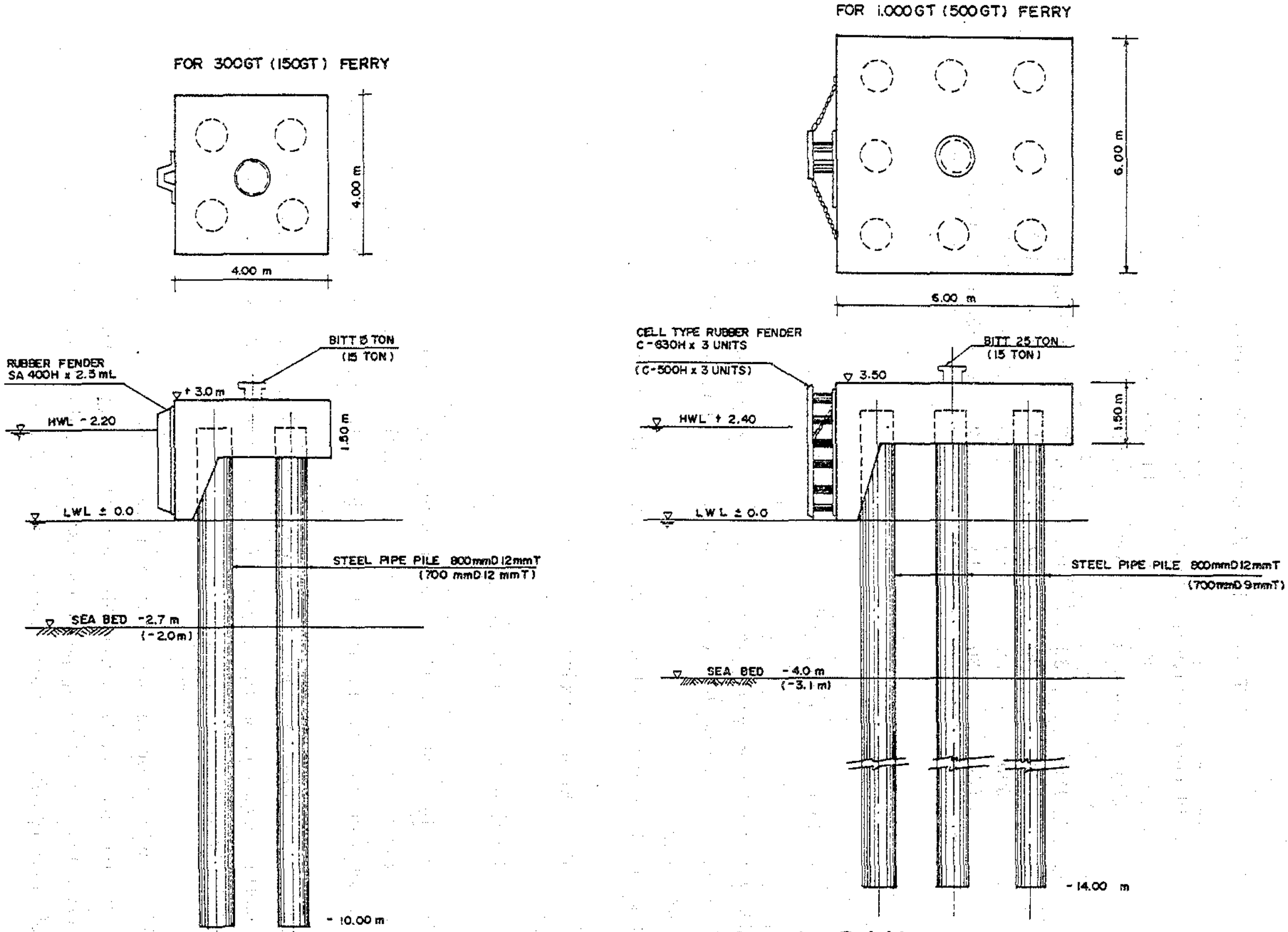


Fig. 6-4-2 General Plan of Breasting Dolphin

(2) Capacity of Mooring Posts

24. The tractive force acting on a mooring post is determined by the wind force and current force acting on a ferry boat at each terminal site.

25. Bow and stern lines are also used to maneuver the ship at berthing and de-berthing operations as assistance to the ship's propeller. Therefore the mooring dolphins and mooring posts should have enough strength to resist these forces.

26. This design recommends to use the following capacity of mooring posts on mooring dolphins and breasting dolphins for each type of ferry boat.

Table 6-4-4 Tractive Force of Mooring Post

Planned Ferry (GT)	Tractive Force on Bollard (t) (on Mooring Dolphin)	Tractive Force on Bitt (t) (on Breasting Dolphin)
150	15	15
300	15	15
500	15	15
1,000	25	25

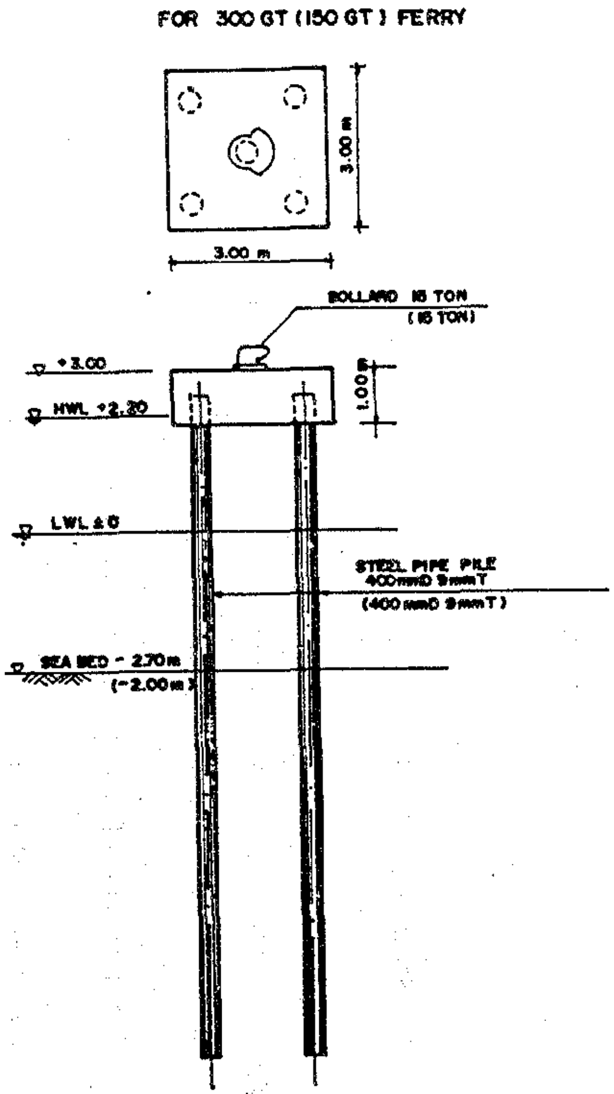
(3) Structure of Dolphin

27. The structural type of mooring dolphin is the same as that of breasting dolphin, namely a concrete top with pile foundation. Typical cross sections of mooring dolphins are shown in on Fig. 6-4-3.

6-4-4 Design of Vehicle Ramp

(1) Type of Structure

28. In order to load or unload vehicles, a ramp should be provided to smoothly connect the ferry boat and the mooring facility. The ramp can be



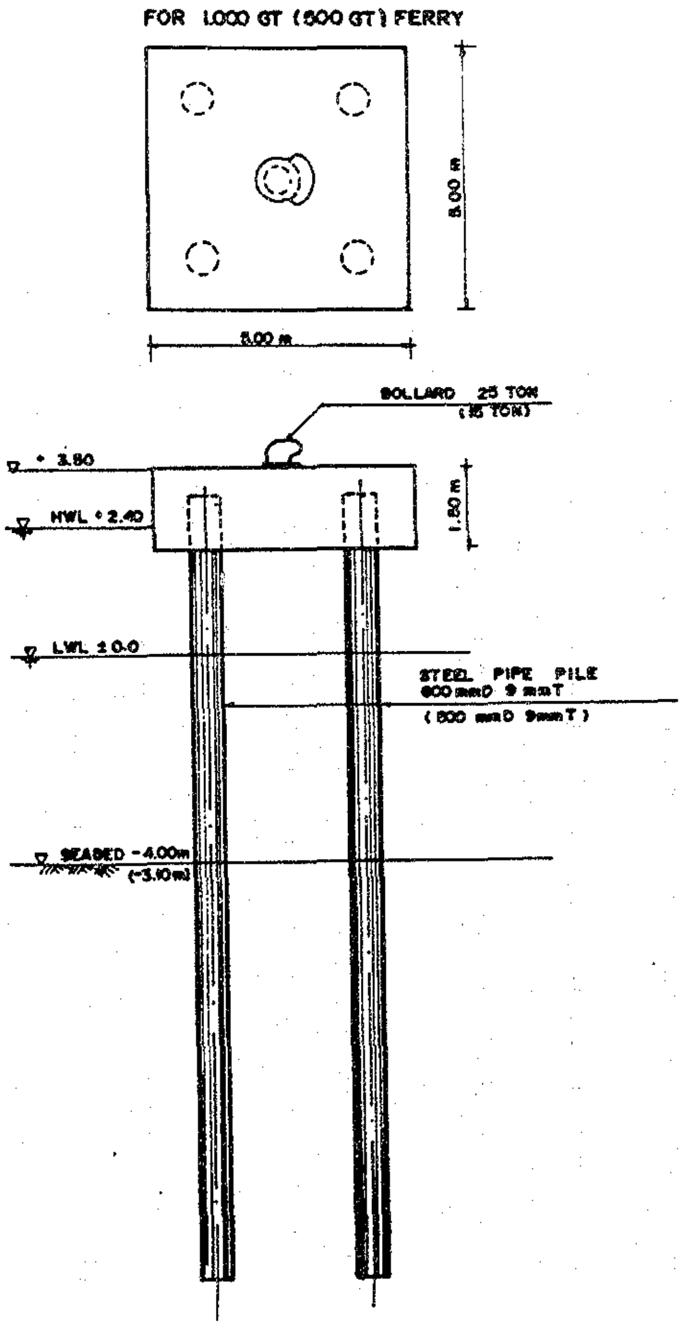


Fig. 6-4-3 Typical Cross Section of Mooring Dolphin

classified into two (2) types, namely fixed type and movable type. Further more the movable type is divided into two (2) types, i.e. natural movable type (pontoon), and mechanical movable type (movable bridge).
According to the International Study Commission of Permanent International Association of Navigation Congress (PIANC), the following ramp requirements are recommended for connection between RO/RO ships and the terminal.

- Where the water level variation is less than ±0.75m a fixed shore ramp or incline suitable for receiving ship ramps should be provided where necessary.

- Where the water level variation exceeds ±0.75m, shore facilities such as a bridge ramp and ancillary equipment should be provided to reduce the net range of water level and bridge ramp variation to ±0.75m.

29. All tidal ranges in the study terminal sites are more than 1.5m. Therefore, the movable type of ramp should be provided, and since pontoon types require high maintenance costs, the movable bridge type is recommended.

(2) Gradients

30. The International Study Commission of PIANC also made recommendations on the gradient of ramp as follows;

- The maximum gradient of the bridge ramp or fixed shore ramp should not exceed 1 in 10 (or 1 in 8 in exceptional circumstances), but particular attention should be paid to the change of gradient and these should be as smooth as possible to enable low ground clearance equipment to be handled safely.

31. However the Technical Standards for Port and Harbour Facility in Japan specify the gradient of ramps for ferry boats as follows;

- The gradient during the use of a movable bridge shall be determined as follows;

1) The gradient should not be more than 17% in the case of a movable

bridge used exclusively for vehicles 1.7m wide or less.

2) The maximum gradient should not be more than 12% in the case of a movable bridge used exclusively for vehicles 2.5m wide or less.

- The gradient of the fixed portion of a vehicle ramp should be determined as follows;

1) The gradient should be 12% or less, in the case of a ramp used exclusively for vehicles 1.7m wide or less.

2) The gradient should be 10% or less, in the case of a ramp used exclusively for vehicles 2.5m wide or less.

32. Considering the situation of the project sites and the above recommendation and standards, a maximum gradient of 12% is applied for the movable bridge ramps of route No.8 and a maximum gradient of 17% is applied for the movable bridge ramps of all other routes.

(3) Width, Length and Radius of Curvature

1) Width

33. The width of movable bridge should be determined based on the widths and locations of the ship ramps of the planned ferry boats to be considered. For example, the berth for a maximum planned boat of 500 GT should also be able to accommodate 300 GT and 150 GT ferries. Therefore, although the ship ramp width of a 500GT ferry is approximately 6.0m, the necessary width of movable bridge is 8.0m as shown below.

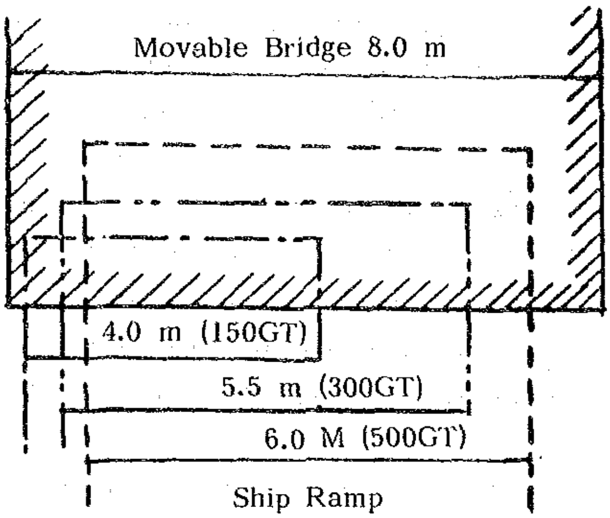


Fig. 6-4-4 Width of Movable Bridge of 500 GT Ferry

34. The same consideration was made for other cases and the widths of movable bridge for each planned boat size are recommended as follows.

Table 6-4-5 Width of Movable Bridge

Planned Ferry Boat (GT)	Recommended Width of Movable Bridge (m)
150	5.0
150/300	7.0
150/300/500	8.0
300/500/1,000	9.0

2) Length

35. The length of movable bridge should be determined by considering the tidal range, the length of ship ramp, the elevation of free board of ship, changes of draft by loading condition, the hinge elevation of the movable bridge, the allowable gradient, changes of gradient and wave condition.

36. The lengths of ship ramps and elevations of free boards of ferry boats have much variety and it is difficult to find out the correlation between these dimensions and type of ferry boat (refer to Fig.6-4A and Fig.6-5A).

37. However, since these dimensions especially the elevation of free board give significant influence to the length of movable bridge, the actual free board elevation of objective ferry boat should be considered to conduct the design of vehicle ramp. In this standard design the lengths of movable bridges are determined by applying the average dimensions obtained from Fig.6-4A and Fig.6-5A as follow.

Table 6-4-6 Length of Ship Ramp and Elevation of Free Board

Planned Ferry Vessel (GT)	Length of Ship Ramp (m)	Elevation of Free Board (m)
150	3.0	0.9
300	3.6	1.0
500	4.3	1.0
1,000	5.3	1.2

38. Therefore, the lengths of movable bridge are different in each terminal. The length will be 7.0m the shortest in Gorua and Daruba, and 22.0m the longest in Muntok.

39. Behind the movable bridge or fixed portion of the vehicle ramp, the horizontal portion of 7.0m long should be provided, but it can be reduced to 4.0m long in case of small facility.

3) Radius

40. The minimum radius of curvature of the lane center line at the curve should be 15m or more.

6-4-5 Passenger Access

41. In the interests of safety, access for passengers should, whenever possible, be separated from vehicular access either by the use of fenced-off lanes on the bridge or fixed ramp, or, preferably, by using a direct approach to the ship's passenger deck. Further details on this matter will be considered in the detailed design stage.

6-4-6 Access Way

42. Access ways to connect the on-land terminal facilities and off-shore mooring facilities are provided where necessary. Structural types of access way are rock causeway or reinforced concrete trestle. One or both are applied to the structure depending on the sea bed condition. The width of the access way has been decided as 8.0m with two vehicle lanes utilizing 6.0m plus pedestrian ways at both sides.

6-5 Design of On-land Facility

6-5-1 Design of Passenger Terminal Building

43. The passenger terminal building consists of a passenger waiting room for departure, administration office and other facilities such as canteen, public toilet, ticketing booth, telephone booth, praying room. etc.

(1) Waiting Room (a1)

44. The required waiting room area is determined by the following formula.

$$a1 = a * n * N * x * y$$

where, a1: Required waiting room area (m2)

a : Required area for one person (generally 1.2 m2/person is used)

n : Number of passengers per boat
n = full number of passenger per boat x utilization ratio. In this design, the utilization ratio of 1.0 is adopted conservatively.

N : Number of ships berthing/deberthing at the same time

In this case, one berth is enough for all the planned terminals, thus N = 1.

x : Concentration ratio

Ratio of "the peak number of passengers in a day" to "the number of passengers per boat". In the case that ferry boats continually arrive at and depart from the same berth and that the passengers to be embarked on the following ferries arrive earlier at the terminal and make joint use of the waiting room, x is larger than 1.0. Empirically, the values of 1.0, 1.6 or 2.0 are used depending on the ferry operation.

In the case of a few trips per day and the interval is sufficiently long, x = 1.0.

In the case of several trips or a few night trips per day, like Bajoe-Kolaka, x = 1.6

y : Fluctuation ratio

This coefficient represents the seasonal fluctuation in the number of passengers. 1.0 is used in the case of small seasonal variation of the number of passengers, and 1.2 in the case of large seasonal variation of the number of passengers. Considering the Hari Raya season, y = 1.2 is adopted in the design.

45. The required waiting room for each planned boat is as follows.

Table 6-5-1 Passenger Waiting Room

Planned Ferry Vessel (G/T)	Required Waiting Room (m2)
150	150
300	450
500	1,200
1,000	1,400

(2) Other Rooms

1) Kiosk/Canteen (a2)
15% of the waiting room (a1) is provided

2) Administration Office (a3)
15% of the waiting room (a1) is also provided

3) Other Utilities (a4)
For the space of other utilities such as praying room, toilets, ticketing booth, telephone booth, store room and machine room, 25% of (a1+a2+a3) is reserved.

4) Public Hall/Passages (a5)
10% of (a1+a2+a3+a4) is reserved for passages, stair-cases and entrance hall.

46. The total area of the terminal buildings for each planned ferry boat is as shown below. Details of the calculations are shown in Table 6-5-1A in Appendix Part 2.

Table 6-5-2 Area of Terminal Building

Planned Ferry Boat (G/T)	Total Area of Terminal Building (m2)
150	300
300	800
500	1,400/2,200
1,000	2,500

6-5-2 Parking Area

47. Parking lots should have sufficient area both for vehicles ready for rolling on and for vehicles waiting for arriving passengers.

(1) Loading Parking Area

48. The required parking area is obtained by the following formula.

$$A1 = a * n * N * x * y$$

where, A1 : Required loading parking area (m2)

a : Required parking area per vehicle (m2)

In this design the following figures are adopted.

8 ton truck	a = 60 m2
4 ton truck	a = 45 m2
2 ton truck	a = 25 m2
Passenger Car	a = 25 m2

n : Number of vehicles per boat

N : Number of ships berthing/deberthing at the same time

x : Utilization ratio

Ratio of "the number of cars to use the parking lot" to "the number of car per boat".

Generally the value x = 0.8 is used. In this study, however the value x = 1.0 is used because in the existing ferry terminals, it was seen that more than the acceptable number of vehicles are waiting for rolling on at the parking lot. However, no vehicles from the arriving boat stay in the parking lot.

y : Concentration ratio

The nature of the coefficient y is the same as x in the equation in paragraph 44.

49. For each planned boat the required loading parking area is summarized as follows. Details of calculations are shown in Table 6-5-2A in Appendix Part 2.

Table 6-5-3 Loading Parking Area

Planned Ferry Vessel (G/T)	Required Loading Parking Area (m2)
150	450
300	650
500	950/1,500
1,000	2,600

(2) Waiting Parking Area (Bus/Taxi Terminal)

50. The required parking area for vehicles waiting for arriving passenger is calculated by the following formula.

$$A2 = a * n1 * N * x * y * z * 1/n2$$

where; A2: Required waiting parking area (m2)

a: Required parking area per vehicle (m2)

n1: Number of passengers

N : Number of ships berthing/deberthing at the same time

x : Utilization ratio (x = 1.0)

y : Concentration ratio (y = 1.0 to 1.6)

z : Utilization ratio of vehicle
Based on the site condition passengers can not leave from the terminal on foot. Thus, z = 1.0

n2: Number of passengers per vehicle
In the planned terminal sites, the mini bus is the most popular transportation and can accommodate 10 to 15 persons. In this design, n2 = 8 was adopted.

51. The required waiting parking area for each planned ferry boat is as follows. Details of calculations are shown in Table 6-5-2A in Appendix Part 2.

Table 6-5-4 Waiting Parking Area

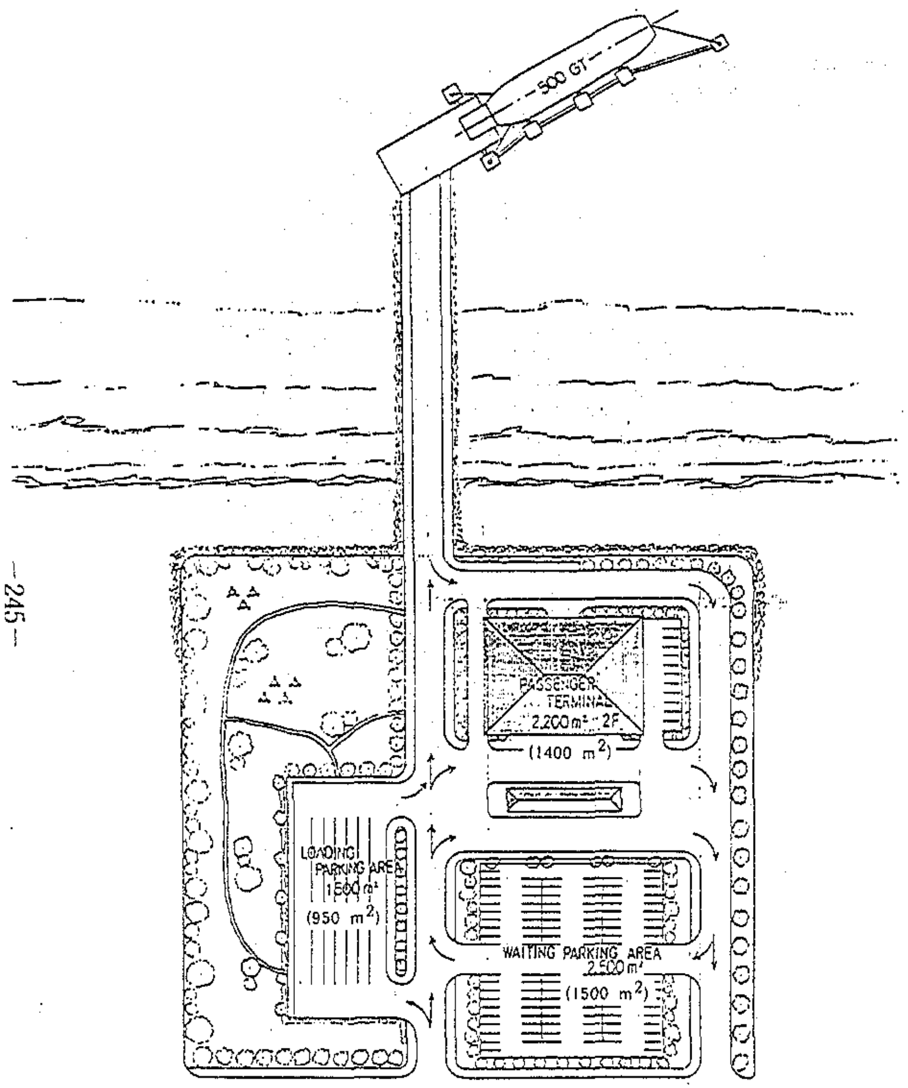
Planned Ferry Vessel (G/T)	Required Waiting Parking Area (m2)
150	350
300	950
500	1,500/2,500
1,000	3,000

6-5-3 Electricity and Water Supply

52. Electricity including lighting for the port area is considered to be provided by generater sets to be installed in each terminal. Water is also considered to be obtained by deep wells to be drilled at each terminal site. Accordingly the utilities of electricity and water supply are considered to be installed within the terminal site. Fuel will be supplied by fuel trucks of PERTAMINA. Therefore, facilities for fuel supply are not considered in this design.

6-6 Layout of Terminal

53. Based on the above study, typical layouts of terminals for each route have been prepared as shown in Fig. 6-6-1 to Fig.6-6-3. These layouts should be modified in accordance with the actual topographic and hydrographic situation of each terminal site.



ROUTE 1 & (9-1)

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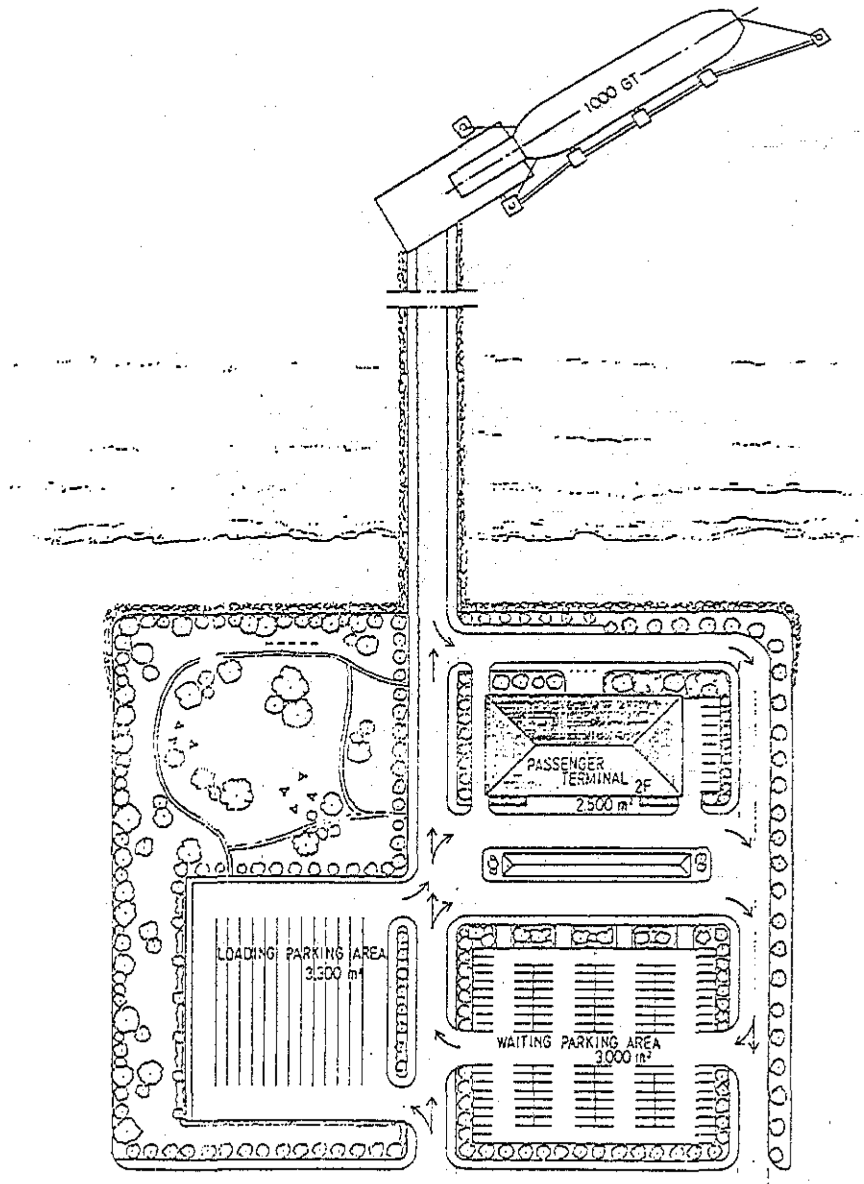
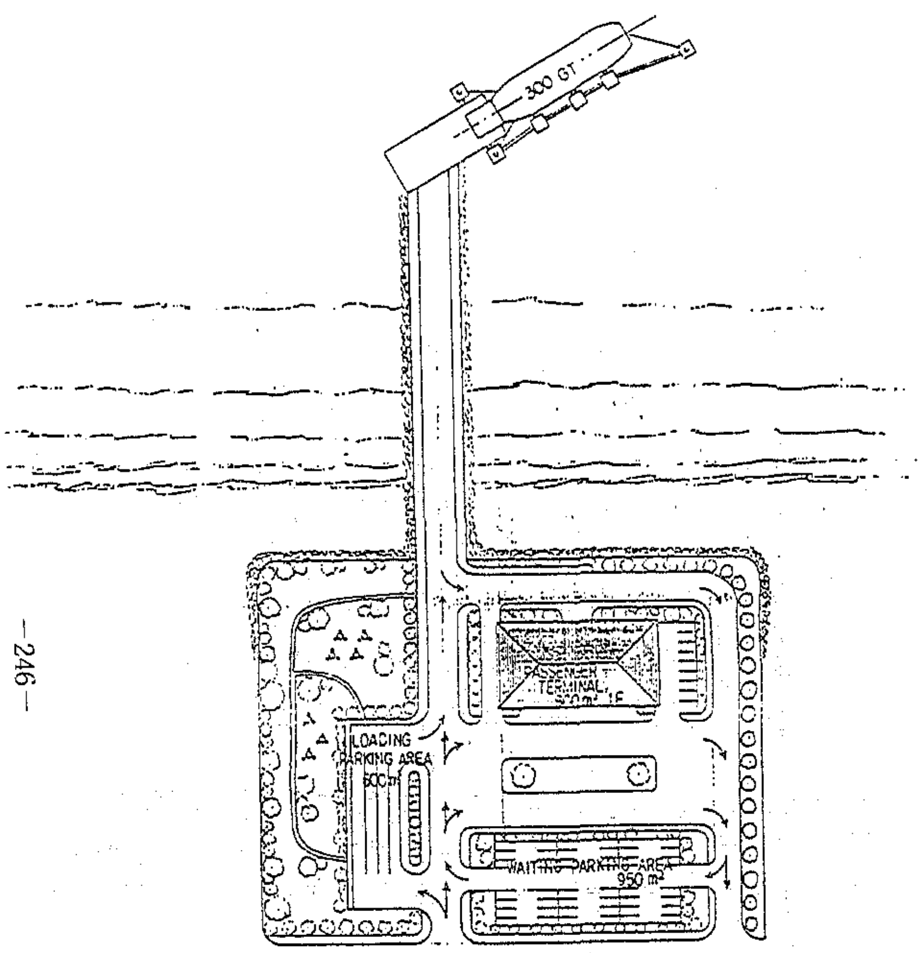


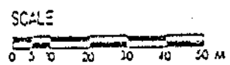
RUTE 8

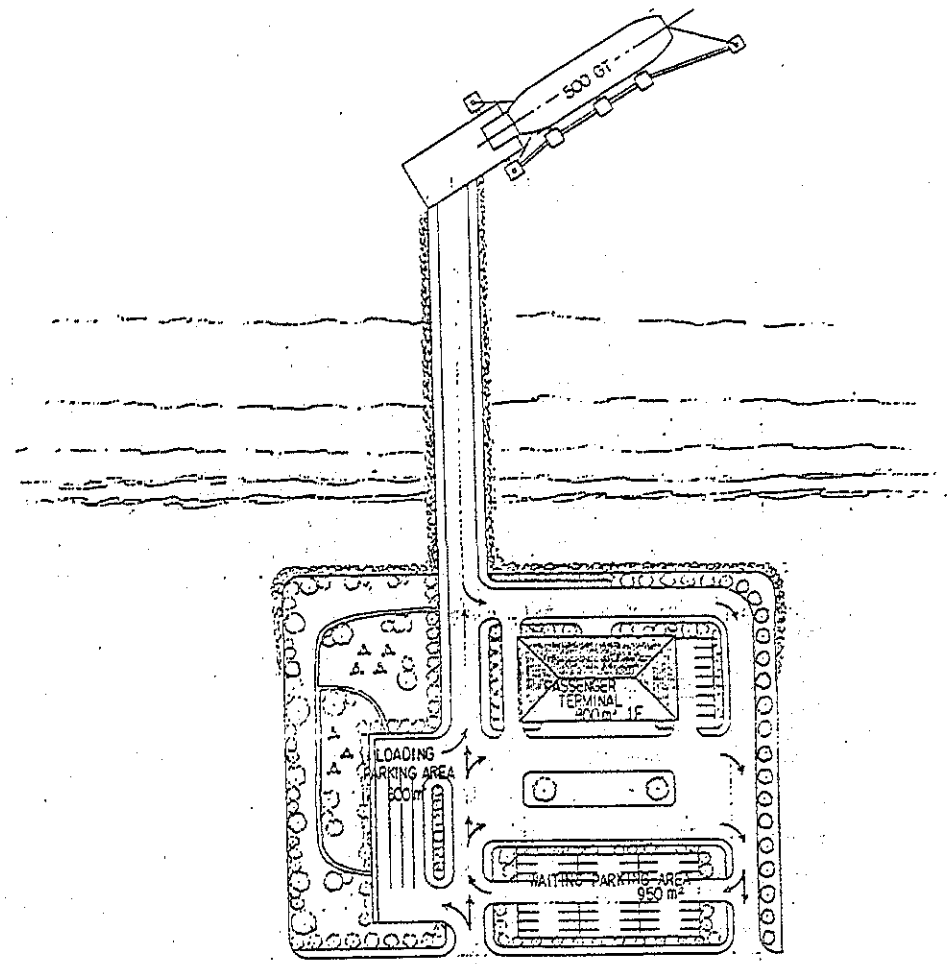
SCALE 0 5 10 20 30 40 50 M

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



ROUTE 2, 7 & 9-2





ROUTE 3

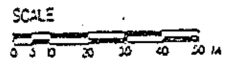
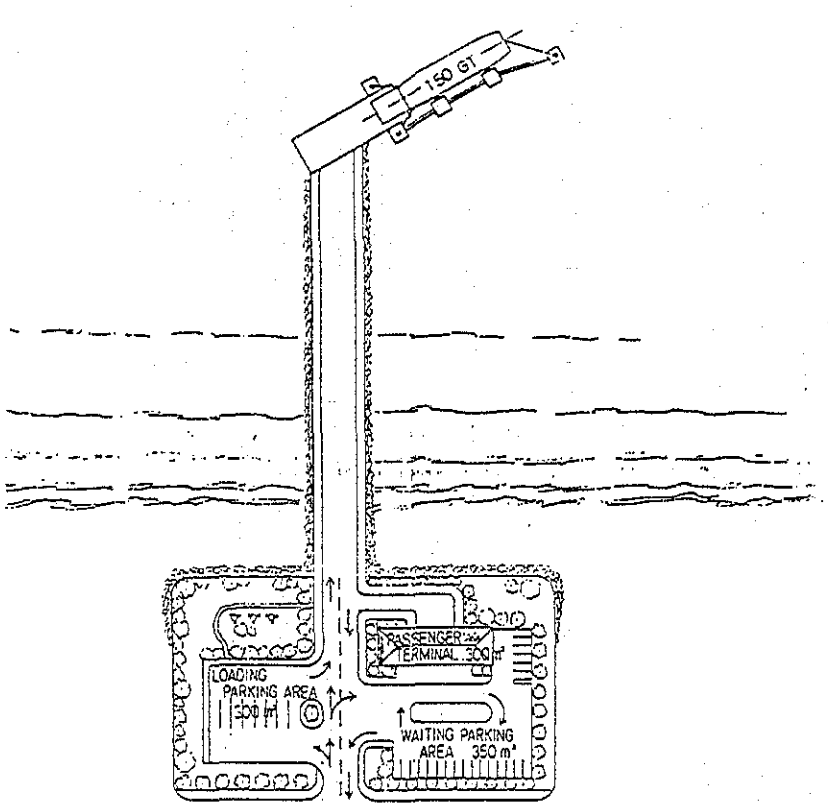
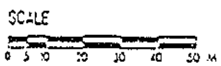
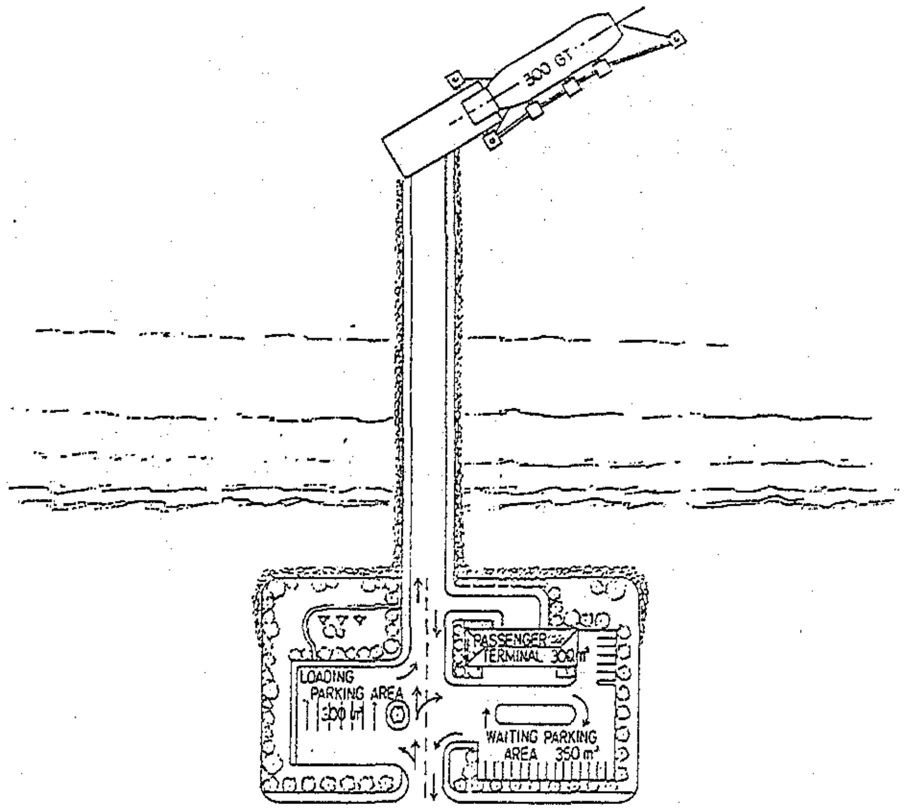


Fig.6-6-2 General Plan of Ferry Terminal (2)



ROUTE 5 & 6





ROUTE 4

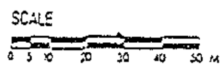


Fig.6-6-3 General Plan of Ferry Terminal (3)

Chapter 7 Estimation of Development Cost of Ferry Service

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 part of the nationwide network, 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.

2. The capacity of local contractors was checked with respect to their experience of marine works and their capability to undertake construction works of the magnitude of the planned ferry terminal facilities.

7-2 Summary of Findings

7-2-1 Capability of Local Contractors

3. From the site survey it was found that the major large general contractors have branch offices at provincial capital cities such as Palembang, Ujung Pandang, Kendari, Ambon, Jayapura, and Kupang in order to obtain and execute land /marine construction works in the provinces.

4. Basically the contractors working in each province are capable of mobilizing the required equipment, materials and manpower to carry out the planned ferry terminal construction works.

7-2-2 Basic Cost of Construction Work

5. There are slight differences in the basic cost of construction works between the provinces due to differences in the unit prices of materials and labour, equipment and material availability, and accessibility of the project site.

7-2-3 Findings from Each Province

6. Findings of the basic cost and unit prices for cost estimation of the terminal development and the capability of local contractors for marine construction works in the respective provinces are outlined as follows;

(1) South Sumatera Province

a) Capability of Contractors

7. There are a number of contractors in Palembang carrying out marine works for the public port(DGSC)/ferry terminal (DGLT) and for factories of private timber companies along the Musi River. These contractors have large numbers of construction equipment and the capacity to mobilize such equipment required for waterfront facilities construction around Palembang and its province including Bangka and Belitung islands.

b) Basic Cost

8. The basic costs of works collected include the cost of procurement of materials, equipments and manpower by the following methods.

9. Basic materials such as stone and sand are procured locally where the construction works are to be carried out. Cement is available in Palembang, and steel products including steel pipe piles are procured from the Krakatau Steel Co. at Merak.

10. Skilled labourers and machine operators are available in the province.

(2) South East Sulawesi Province (Kendari and its region)

a) Capability of Contractors

11. There are some contractors in the Kendari area who have sufficient road construction equipment and the capacity to mobilize such equipment to Buton, Muna, Wowoni and Kabaena Islands.

12. Almost all the construction works in Buton and Muna islands, particularly road betterment works and rehabilitation works financed by IBRD were carried out by these contractors based in Kendari.

b) Basic Cost

13. The basic costs of works collected include the cost of procurement of materials by the following methods.

14. Construction materials such as stone, soil material required for reclamation, and concreting works are procured locally where the works are to be carried out. Cement and steel products are procured and brought from Ujung Pandang.

15. Skilled labourers and machine operators are available in the province.

(3) Maluku Province including Morotai

a) Capability of Contractors

16. There are a number of contractors in Maluku who have carried out marine works, but only a few contractors have proper and sufficient construction equipment such as pile driving equipment, barges and excavators for dredging.

17. The contractor who is presently working on construction of Ternate/ Sidangoli ferry terminals has some construction works experience for local ports of DGSC in Maluku province including the Morotai islands region.

b) Basic Cost

18. The basic costs of the works include the cost of procurement of materials and equipment by the following methods.

19. The materials and equipment have been mobilized and procured for the project as follows.

- Stone, sand for concrete works, reclamation and timber materials were procured locally at the project sites i.e.; Ternate and Sidangole,

- Cement, RC bars, steel material and PC piles were procured from Surabaya, Jawa through Ambon.
- All the construction equipment such as pile driving hammers, barges, mobile cranes, concrete mixing plants, dump trucks, rollers for road and pavement work are owned by the contractor and mobilized to each site from Ambon city.
- The skilled labourers and machine operators are available in Ambon and Ternate.

(4) Irian Jaya Province

a) Capability of Contractors

20. There are many contractors in Irian Jaya province certified by the Government to participate in tenders called nationally for large scale contracts financed by the central government agencies. However these contractors concentrate on road projects, bridge construction, building works and utilities supply works.

21. The contractor who is presently working for the Biak port construction project has the necessary construction equipment for road related works such as dump-trucks and rollers and the capacity to mobilize construction equipment required for marine works such as pile driving hammers, mobile cranes, barges and concrete mixing plants from Jayapura.

22. The large general contractors known nationally have branch offices in Jayapura to obtain works in Irian Jaya.

b) Basic Cost

23. The basic costs of works collected have been calculated based on the following procurement methods.

24. The construction materials and equipment have been mobilized and procured for the works as follows,

- Stone and wood are procured locally at the Biak island project site. Sand for concrete is procured from Yapen island.
- Steel materials, piles, RC bars, PC piles and cement are procured and brought from Surabaya directly.
- All the construction equipment such as pile driving machines, barges, concrete mixing equipment and mobile cranes are mobilized from Jayapura.
- Skilled labourers and equipment operators are brought from Jawa, Maluku, Sulawesi areas a project basis by the contractor since skilled labourers and experienced operators are not available locally in Irian Jaya province.

(5) Nusa Tenggara Timur Province (N.T.T)

a) Capability of Contractors

25. There are a number of small local construction companies who undertake building works and road betterment works but generally sub-contract small parts of large scale projects from national general contractors. These local contractors do not have sufficient financial capacity to hold enough types and quantities of equipment and manpower for all kinds of construction works.

26. The large national general contractors have branch offices in Kupang to undertake construction projects in Nusa Tenggara Timur province.

27. They have experience of construction of land/marine works, own the required equipment and have the financial capacity to arrange/mobilize construction materials and manpower for the works.

28. There are no difficulties for construction works in Kupang area. Materials, equipment and manpower can be arranged/mobilized, but in the case of projects located in the isolated islands or remote areas in the province it is difficult to arrange/mobilize these items in the right time and with the required quantities since there are no regular shipping services to such places from Kupang.

29. There are skilled labourers, experienced equipment operators and pile hammer operators available in Kupang area.

b) Basic Cost

30. The contractor working on construction of the ferry terminal at Pantai Baru of Rote island procured the construction materials as follows;

- Steel pipe piles from Jakarta
- PC piles and RC bars from Surabaya
- Cement and sand for concrete works from Kupang
- Stones and timber from Rote island

All the equipment and manpower are mobilized from Kupang.

31. The basic costs of the works include the cost of procurement of materials, equipment and transportation cost as above.

7-3 Cost Estimation for Terminal Development

7-3-1 Assumptions for Cost Estimation

32. Cost estimations for ferry terminal construction at each province are based on the following assumptions

(1) As explained above 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.

(2) 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.

(3) The construction costs are 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 basic 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 Maluku in 1990. These costs are the latest data available for a ferry terminal construction project in the eastern part of Indonesia,

d) The components of works such as concrete and piling works for dolphin, fixed deck, steel and civil works for pontoon with movable bridge, and movable bridge with hydraulic system on a civil works foundation are analyzed to estimate the cost of such structures for other provinces.

33. For example, the cost of a dolphin at Biak is estimated from the cost at Ternate as follow.

a) The base costs of concrete works and piling works are compared between Ternate and Biak and the ratio for adjustment of such costs from Ternate to Biak is calculated

b) The base cost of a dolphin structure at Ternate is divided into the cost components of concrete works and piling works

c) The ratios of concrete and piling works at Biak based on Ternate are multiplied by the amounts of concrete works and piling works of Ternate and these components are combined to determine the cost of a dolphin at Biak.

34. Based on the above assumptions and procedures the cost estimation for each terminal development facility is calculated.

7-3-2 Comparison of Unit Price of Materials and Basic Cost of Works

35. The basic costs of works and unit prices of materials are different depending on the local conditions for procurement of materials and equipment, accessibility to the site and availability of manpower.

36. The unit prices of materials and labour are collected from the office of the Public Works Department of each provincial Government which publishes such prices annually,

37. The basic costs of works such as concrete works, piling works, reclamation works, pavement works, building works, and utility supply works are basically collected from the DGLT provincial office which is executing the current contract for construction/development of ferry terminal project in the region.

(1) Basic Cost of Works

38. Comparison by province of basic costs of works actually applied for contracts are shown in the following Table 7-3-1.

39. For comparison purposes the basic costs which have been applied for works in different years have been adjusted to the prices of 1992 with a 10% increase per year.

Table 7-3-1 Comparison of Basic Cost of Works

Basic Cost (Unit: Rp.)	PROVINCES				
	Maluku, (Ternate)	N.T.T (Rote Is)	South Sulawesi (Kendari)	Irian Jaya (Biak)	South Sumatera (Palembang)
Concrete Works, /m3	1,100,000	1,200,000	900,000	960,000	850,000
Reclamation Works, /m3	14,000	20,000	25,000	60,000	48,000
Piling Work Material /kg	2,250	2,250	2,250	2,300	2,250
Driving /m	55,000	115,000	100,000	90,000	105,000
Pavement Works, /m2	56,500	50,000	45,000	44,000	36,000
Building Works /m2	604,000	450,000	500,000	300,000	564,000

(2) Unit Price of Materials and Labour

40. The unit prices of materials and labour at each province and sites thereof, which are 1991 prices as published by the Public Works Department, are compared between the provinces and shown in Table 7-3-2.

41. According to past trends and comments of the Public Works Department there is no substantial increase between 1991 and 1992. Therefore, the prices are not adjusted.

7-3-3 Establishment of Construction Cost

(1) Base for Estimation of Construction Cost

42. It was found that there are slight differences in the basic costs of construction works for each province depending on the various elements of local conditions.

a) Quantities of Works for Each Planned Terminal

43. The quantities of works for each planned ferry terminal are estimated by taking into account the following elements.

- the local conditions of the selected sites,
- whether the work consists of rehabilitation of an existing facility or a new construction, and
- the standardized size of ferry ship to be engaged between the proposed terminals.

b) The Ferry Terminal Facility

44. The following facilities are considered as standard and typical for ferry terminals.

- *Breasting and mooring dolphins for berthing ships,*
- Movable bridge with hydraulic system for ship ramp,
- Trestle pile support and rock mound causeway for approach between the land and jetty,

Table 7-3-2 Comparison of Unit Prices of Material and Labour

(UNIT; Rp.)

PROVINCE	MALUKU			N.T.T	S.E.SULAWESI			IRIANJAYA		S.SUMATERA
ITEM	Ambon	Ternate Sidempoll	Moroti	Rote Is.	Kendari	Buton Is.	Muna Is.	Biak	Yapen Is.	Palemlang
Material Cement/bag	7,100	8,000	7,200	13,000	7,000	7,200	7,100	8,000	8,750	5,500
R.C.Bar/Kg	900	1,800	1,800	1,000	1,200	1,400	NA	1,200	1,330	1,200
Sand for Concrete/m3	15,000	12,000	15,000	15,000	12,000	10,000	17,000	20,000	24,000	20,000
Gravel for Concrete/m3	20,000	20,000	28,500	17,500	21,500	20,000	17,500	75,000	22,000	30,000
Labour Skilled labour	5,000	5,500	5,500	5,250	6,000	5,000	6,000	6,500	7,500	6,000
Unskilled labour	3,500	4,000	4,000	3,000	3,000	3,500	3,500	4,000	5,000	3,500
Stone Workers	5,500	5,500	5,500	5,000	3,500	NA	3,500	6,500	7,500	6,000
Machine Operators	-	14,000	30,000	20,000	10,000	12,000	12,000	20,000	20,000	20,000

- Reclamation works for land development of the terminal area with revetments,
- Pavement works for parking area and road construction,
- Building works for construction of passenger waiting hall, control rooms for movable bridge operation,
- Utility supply facilities for water (deep-well reservoir) and electric power (generator, cabling), and
- Truck scale equipment is considered for the major trunk road lines such as the Bajoe- Kolaka route.

45. A summary of the project cost estimation based on the required quantities of works at each proposed terminal is shown in Table 7-3-8.

(2) The Construction Cost of Ternate/Sidangole Ferry Terminal

46. The construction costs of Ternate/Sidangole are considered applicable as the base costs for the planned facilities at each ferry terminal in the respective provinces considering the following aspects.

- The project sites of Ternate and Sidangole ferry terminals in Maluku province are located in the middle of Eastern Indonesia.
- The scope and extent of the required facilities have been designed for a 500GT ferry boat.
- The construction includes the above listed typical ferry terminal facilities.
- The construction works have been in progress since 1990 with the market prices of Maluku province in 1990, which are the latest prices applied for such works in the regions concerned.
- The costs have covered indirect costs, mobilization costs and transportation costs of necessary equipment, materials and labour for the works.

47. The result of applying these costs for the other provinces, adjusted with a 10% increase per year to obtain the base cost of 1992, is shown in the following Table 7-3-3.

Table 7-3-3 Adjusted Construction Cost of Facility for 500GT Ferry as of 1992

Facility	Construction Cost (unit; Rp.)
Breasting Dolphin (4mx4m,with SPP)	187,200,000 per unit
Mooring Dolphin	125,000,000 per unit
Fender,(2-cell type with steel frame)	22,500,000 per unit
Catwalk (1m width, concrete slab)	1,850,000 per m
Trestle,(width 8m with SPP support)	2,400,000 per m2
Causeway (w = 8m with rock mounds)	120,000 per m2
Fixed Deck (w = 8m with SPP support and concrete slab)	2,400,000 per m2
Movable bridge (steel structure,8mx25m)	317,000,000 per set
Pontoon (steel box 130mx12mx5m)	367,000,000 per set
Reclamation works, (cut/fill)	22,500 per m3
Revetment works (concrete block mound)	275,000 per m
Road works (w = 6m with asphalt paving)	76,000 per m2
Pavement works(gravel base/asphalt paving)	56,500 per m2
Building works (passenger hall)	610,000 per m2
Utility supply; Water supply(deepwell),	400,000,000 per set
Electric power supply	300,000,000 per set

3) Components of Works in the Main Structures of Terminals

48. The components of the following structures are determined and the proportional rate of the cost of works based on the Ternate terminal construction are established and shown in Table 7-3-4.

Dolphin; concrete works, R.C. bars
Fixed bridge; concrete works, R.C. bars
Tresite; concrete works, R.C. bars
Catwalk; concrete works, R.C. bars
Pontoon; steel box, steel bridge
Movable bridge; steel structure with hydraulic equipment, civil works foundations

Table 7-3-4 Components of Structure Works

ITEM	TYPE	UNIT	QUANTITIES	UNIT PRICE	COST	RATE
Dolphin	Concrete	m3	56.250	1,100,000	61,875,000	0.52
	Pile	unit	9	5,807,250	52,265,250	0.44
	" Driving	m	85.500	55,000	4,702,500	0.04
	Bit	"	3	0	0	0.00
				TOTAL (Rp./Unit)	118,842,750	1.00
		w=	174 Kg/m			
		L=	15.000 m			
		W=	2,610 Kg/Unit			
		(	2,225 Rp./Kg)			
		Rp.=	5,807,250 /Unit			
Fixed Deck	Concrete	m3	331.500	1,100,000	364,650,000	0.74
	Pile	unit	28	3,966,063	111,049,750	0.23
	" Driving	m	266.000	55,000	14,630,000	0.03
				TOTAL (Rp./Unit)	490,329,750	1.00
		w=	115 Kg/m			
		L=	15.500 m			
		W=	1,783 Kg/Unit			
		(	2,225 Rp./Kg)			
		Rp.=	3,966,063 /Unit			
Trestle (Pile Pitch 5.5m)	Concrete	m3	4.216	1,100,000	4,637,600	0.77
	Pile	unit	0.364	3,454,313	1,257,370	0.21
	" Driving	m	2.727	55,000	149,985	0.02
				TOTAL (Rp./m)	6,044,955	1.00
		w=	115 Kg/m			
		L=	13.50 m			
		W=	1,553 Kg/Unit			
		(	2,225 Rp./Kg)			
		Rp.=	3,454,313 /Unit			
Cat Walk (Span 20m)	Concrete	m3	2.500	1,100,000	2,750,000	0.88
	Pile	unit	0.100	3,326,375	332,638	0.11
	" Driving	m	0.750	55,000	41,250	0.01
				TOTAL (Rp./m)	3,123,888	1.00
		w=	115 Kg/m			
		L=	13.000 m			
		W=	1,495 Kg/Unit			
		(	2,225 Rp./Kg)			
		Rp.=	3,326,375 /Unit			
Pontoon (Palembang case)	Steel Box (with anchor pile 30m * 12m * 1.8m) L B H				305.700	0.60
	Bridge (Truss type t= 45ton, W=8m, L=25m)				200.300	0.40
				TOTAL (MIL.Rp./set)	506.000	1.00
Movable Bridge (Ternate case)	Steel structure with hydraulic equipment (65ton, for 500GRT)				278.000	0.45
	Civil Works Foundation				342.000	0.55
				TOTAL (MIL.Rp./set)	620.000	1.00

4) Construction Cost of Facilities at Each Province

49. The latest possible construction costs of the ferry terminal facility were collected from each province.

50. These construction costs, which have been applied for the works at a different year, are adjusted by an increase of 10 % per year for comparison purposes.

51. The ratio of the construction costs based on the Ternate/Sidangole costs are calculated and shown in Table 7-3-5.

52. These ratios are applied for estimating the base cost of the items of works at the proposed site of each province. In the case where such works are not available the base cost is calculated by taking the cost of similar works from another province.

Table 7-3-5 Comparison of Base Costs of Works in the Provinces

	PROVINCE and LOCATIONS				
	Maluku Ternate/ Sidangole/ Ambon (1)	N.T.T Rote Island (2)	SE.Sulawesi Kendari/ Bajoe/ Kolaka (3)	Irian Jaya Biak (4)	S.Sumatra Palembang/ Belitung/ Bangka/ (5)
Concrete works	1.0	1.09	0.82	0.87	0.77
Reclamation works	1.0	1.50	0.72	1.07	2.14
Piling works	1.0	2.09	1.82	1.64	1.91
Pavement works	1.0	N.A	0.80	0.78	0.64
Building works	1.0	0.75	0.80	0.50	0.93

53. Based on the construction costs indicated in Table 7-3-3 the construction cost of the planned ferry terminal facilities to be developed in other provinces are estimated by adjusting by proportional increase/decrease the difference in costs of

- concrete works
- reclamation works
- piling works
- pavement works
- building works

(5) Comparison of Base Cost at Isolated Area of a Province

54. The base costs for isolated areas are estimated by multiplying the average ratio of increase in the costs of materials and labour between the locations in the province as shown in Table 7-3-2.

55. In the case where the proposed ferry terminals are to be located in an *isolated area or remote islands* the base cost of construction works as estimated for application in the relevant province is adjusted by the following manner to account for additional transportation cost for mobilization of the required manpower and materials to the site.

a) Moroti, Maluku

The average increase of materials and labour costs is 20%. The costs of works at Moroti are adjusted by an increase of 1.20 from the cost at Ternate.

b) Larantuka/Kalabahi, N.T.T

The costs for N.T.T are taken from the case of Pantai Baru on Rote island, which is isolated from Kupang. The costs thereof are estimated under such conditions that the costs for the proposed locations will be subject to similar conditions as Rote Island, therefore the costs have been taken without any adjustment.

c) Yapen Island/Nabire, Kimi Irian Jaya.

The average increase of materials and labour costs is 25%. The costs of works for these locations are adjusted by an increase of 1.25 from the cost at Biak.

d) Wowoni/Muna/Kabaena Islands, South East Sulawesi

The average increase of materials and labour costs is 10%. The costs of works in these islands are adjusted by an increase of 1.10 from the cost at Kendari.

e) Bangka/Belitung Islands

The prices of materials and labour in these islands are the same as in Palembang therefore the costs of works for these islands is taken from the cost at Palembang without adjustment.

(6) Applicable Costs for Estimation of Ferry Terminal Cost at Each Proposed Site

56. The applicable base costs of the terminal facility at the planned sites have been determined and are shown in the Table 7-3-6.

57. The applicable construction costs of the ferry terminal facilities at the respective provinces are shown in Table 7-3-7.

(7) The Construction Cost of Ferry Boats

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

(8) The Total Project Cost of Planned Ferry Routes

59. 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
- procurement cost of new ferry boats to be engaged on the planned routes.

The above costs as estimated include a physical contingency, Consulting costs and VAT for the contract.

60. The project costs for each route are summarized in Table 7-3-8.

Table 7-3-6 Applicable Base Cost according to Route

Route No.	Applicable Terminal Site	Applicable Base Cost for the Works
1	Hunimor/ Waipirit (Maluku)	Base cost at Ternate
2	Biak (Irian Jaya)	Base cost at Biak
2	Saubeba/Kabuaena/Kimi (Irian Jaya)	The average increase of materials/labour is 25%. The cost of works is increased by 1.25 from the cost at Biak
3	Larantuka/Waiwerang /Lewoleba/Baranusa/ Karabahi(N.T.T)	The planned sites have similar conditions to Pantai Rote Is. isolated from Kupang. The costs at Kupang are applied without adjustment.
4	Sikeli/Pulemo (SE Sulawesi, Kabaena Is)	The average increase of materials/labour is 10%. The cost of works is increased by 1.10 from the cost at Kendari.
5	Mawasangka/Dongkala (SE Sulawesi, Muna Is,Kabaena Is)	Same as above. The cost of works is increased by 1.10 from the cost at Kendari
6	Kendari (SE.Sulawesi)	The cost at Kendari
6	Langgara (wowoni Is) (SE Sulawesi)	Same as route 5. The cost of works is increased by 1.10 from the cost at Kendari
7	Gorua/Daruba (Moroti Is,Maluku)	The average increase of materials/labour is 20%. The cost is increased by 1.20% of the cost at Ternate
8	Bajoe/Kolaka (South, SE Sulawesi)	The cost at Kendari
9	Palembang/Muntok/ Sadai/Tanjung Barong (South Sumatera,Banka,Belitung Is)	The cost at Palembang

Tale 7-3-7 Comparison of Base Cost of Construction Works

(UNIT; MILLION Rp.)

PROVINCE			MALUKU		IRIANJAYA		N.T.T.	S.E.SULAWESI			S.SUMATERA	
APPLICABLE TERMINAL NAME			Hunimua Waipirit	Morotai Gorua Daruba	Biak Mokmer	Saubeba Kabuena Kimi	Larantuka Waiwerang Lewoleba Baranusa Karabahi	Bajoe Kolaka	Sikeli Pulemo	Kendari Langgara Mawasangka Dongkala	Palemb'g	Sadai Muntok Tj.Barong
FACILITIES	ITEM	unit	500GRT	300GRT	300GRT	300GRT	500GRT	1000GRT	300GRT	150GRT	1000GRT	300GRT
	Mobilization	L.S.	200.000	240.000	200.000	250.000	200.000	200.000	220.000	220.000	200.000	200.000
WATERFRONT FACILITIES	1.Breasting Dolphin	unit	209.705	104.202	127.744	159.680	366.701	312.745	145.600	132.363	315.004	133.544
	2.Mooring Dolphin	unit	124.816	43.715	46.068	57.585	188.826	156.475	52.806	48.005	158.171	48.501
	3.Fixed Deck	m2	2.400	2.880	2.100	2.625	3.240	1.720	1.892	1.892	1.850	1.850
	4.Pontoon with Bridge	set	570.000	684.000	570.000	712.500	570.000	510.000	561.000	561.000	506.000	506.000
	5.Movable Bridge	m2	13.660	15.700	12.690	14.230	14.460	11.680	12.230	12.230	11.250	11.250
	6.Cat Walk	m	1.850	2.220	1.610	2.013	1.700	1.520	1.672	1.672	1.430	1.430
	7.Trestle	m2	2.410	2.892	2.100	2.625	3.168	1.720	1.892	1.892	1.850	1.850
	8.Causeway	m	0.100	0.120	0.110	0.138	1.520	0.070	0.077	0.077	0.080	0.080
	9.Dredging	m3	0.030	0.036	NA	0.000	NA	NA	NA	NA	0.010	0.010
LAND FACILITIES	1.Reclamation	m3	0.023	0.028	0.060	0.075	0.020	0.025	0.028	0.028	0.048	0.048
	2.Cut and Fill	m3	0.030	0.036	0.060	0.075	0.020	0.025	0.028	0.028	0.048	0.048
	3.Revetment	m	0.270	0.324	0.250	0.313	0.294	0.850	0.935	0.935	0.580	0.580
	4.Road Works	m2	0.080	0.096	0.060	0.075	0.060	0.055	0.061	0.061	0.163	0.163
	5.Pavement	m2	0.060	0.072	0.050	0.063	0.050	0.045	0.050	0.050	0.036	0.036
	6.Building Works - passenger terminal - control room	m2	0.610	0.732	0.300	0.375	0.450	0.500	0.550	0.550	0.600	0.600
	7.Utility Supply - water supply - electricity	set	700.000	840.000	700.000	875.000	700.000	700.000	770.000	770.000	700.000	700.000

Table 7-3-8(1) Summary of Project Cost of Each Route

(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 7-3-8(2) Summary of Project Cost of Each Route

(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	1	1,100,000,000	10,744,628,500
	MAWASANGKA (SE.Sulawesi/ W.Muna)	New	5,335,258,000	150			
6	KENDARI (SE.Sulawesi)	New	3,441,280,000	150	1	1,100,000,000	8,619,675,000
	LANGGARA (SE.Sulawesi/ Wawonii)	New	4,078,395,000	150			
7	GORUA (Maluku/ Halmahera)	New	5,350,075,000	300	1	2,100,000,000	15,801,830,000
	DARUBA (Maluku/Daruba)	New	8,351,755,000	300			
8	BAJOE (SE.Sulawesi)	Exist	13,706,940,000	1000	5	35,000,000,000	57,833,665,000
	KOLAKA (SE.Sulawesi)	Exist	9,126,725,000	1000			
9-1	PALEMBANG (S.Sumatra/ Sumatera)	Exist	9,033,688,000	500	2	7,000,000,000	24,419,196,000
	MUNTOK (S.Sumatra/ Bangka)	New	8,385,508,000	500			
9-2	SADAI (S.Sumatra/ Bangka)	New	4,821,723,000	300	1	2,100,000,000	11,747,046,000
	TANJUNG BARONG (S.Sumatra/ Belitung)	New	4,825,323,000	300			

Chapter 8 Priority Study of the Planning Routes

8-1 Evaluation of the Proposed Nine Routes for the Feasibility Study

8-1-1 Methodology of Evaluation of the Routes

1. Two methods are applided for the selection of the four Feasibility Study Routes from the Proposed Nine Routes:

1) to select several evaluation items and to evaluate the items quantitavely,
2) to evaluate according to some concepts and procedures for selection.

8-1-2 Selection of Evaluation Items

2. (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.
2) 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.
3) 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.

3. (2) Selected Evaluation Items

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), 2) and 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).

8-1-3 Evaluation of each evaluation item on the nine proposed routes

(1) Routes to be evaluated

4. 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

(2) Results of Evaluation

5. According to the evaluation items and criteria, the thirteen routes are evaluated as shown in Table 8-1-1A. 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.

6. Table 8-1-1A 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

7. 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 1-1-1A, 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.

8. 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 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

9. 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.

10. 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.

11. The routes remaining after above screaning are:

Route 2-1, 2-2, 3-1, 3-2, 3-3, 4, 5, 6, 7

12. 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

13. The selected routes based on the Alternative A are Routes 8, 9-1, 3-1 and 2-1 as shown in Table 8-1-1.

14. 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 volumes on this route are the largest among those of the thirteen study routes. Extension cost for this route is also the highest.

15. 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.

16. Route 1 is also considered as a regional trunk route and the transportation demand volume is high. However as the extension cost for this route is not so high and considering that the Indonesian Government's own budget and technology would be sufficient, this route is not given a high priority.

17. 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

18. Four selected routes from each regional groups are as follows(shown in

Table 8-1-1):

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

19. 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.

20. 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.

21. 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.

22. 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.

23. 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.

24. 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

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

1) 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.
2) Demand potential of ferry transportation is an essential element in examining the feasibility in the short term plan.
3) 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

26. 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.

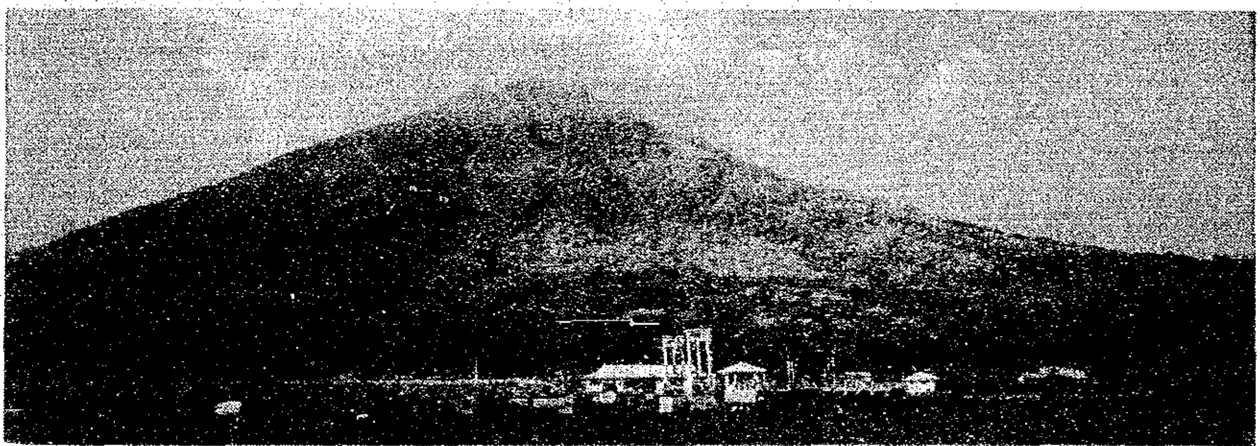
Table 8-1-1 Route Selection for Feasibility Study

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	△	▲	△	○	○		◎	◎		

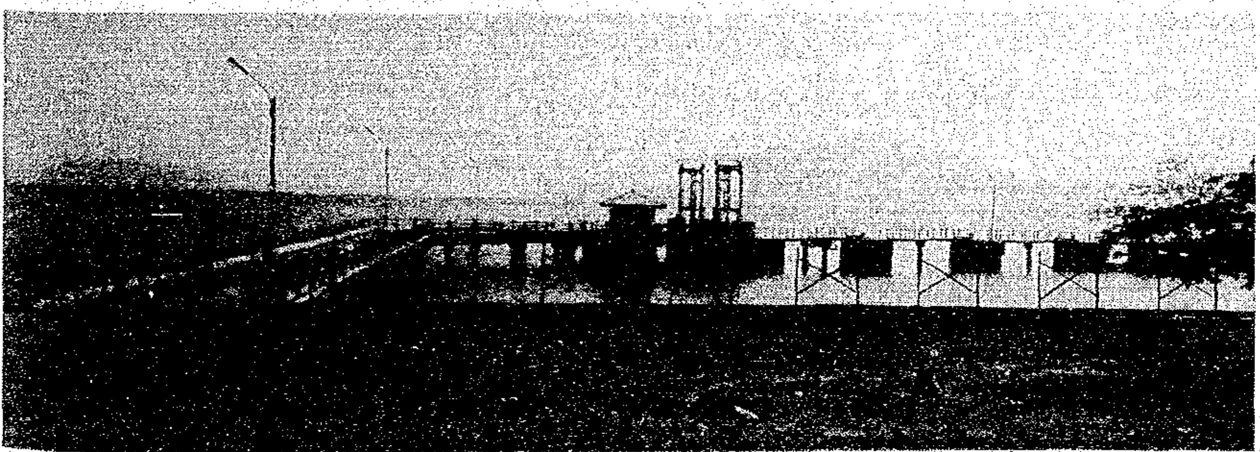
① Demand Volume/Year(2010)
①-1 Number of Passengers/Year(2010)
①-2 Volume of Cargo/Year(2010)
② Project Scale(Construction Cost)
③ Development Efficiency
③-1 (①-1)/②
③-2 (①-2)/②
④ Necessity of Reinforcement/Improvement
④-1 Existing of Ferry Service
④-2 Convensional Sea Transportation
⑤ Number of Existing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

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 passengers/vehicles (cargoes) should be provided between origin and destination through ferry, ferry terminal and public roads linked with the ferry terminal.
2) 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. Passenger terminal should provide all necessary facilities to meet passengers' needs.

(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)-Saubeba(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. Layout of facilities, 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 Location

1. The location of each terminal of the study routes are shown below;

Table 2-1-1 Terminal Locations

Route	Location	Coordinates	Regency	Province
Biak-Yapen	Mokmer	1° 11'54" S 136° 18'55" E	Biak, Teluk Cendrawasih	Irian Jaya
	Saubeba	1° 42'37" S 136° 21'25" E	Yapen, Yapen Waropen	Irian Jaya
Larantuka - Terong - Lewoleba	Terong Wai-werang	8° 23'27" S 123° 07'52" E	Adonara, East Flores	East Nusa Tenggara
	Lewoleba	8° 22'16" S 123° 24'05" E	Lomblen, East Flores	East Nusa Tenggara
Bajoe-Kolaka	Bajoe	4° 32'56" S 126° 23'10" E	Bone	South Sulawesi
	Kolaka	4° 03'25" S 121° 35'28" E	Kalaka	South East Sulawesi
Plembang - Bangka	Palembang	3° 00'22" S 104° 44'54" E	Palembang	South Sumatera
	Muntok	2° 04'18" S 105° 09'46" E	Bangka	South Sumatera

2-2 Topographic Conditions

2. A topographic survey was carried out for each terminal from September to November 1992 using the following criteria.

1) Mapping Scale : 1 : 500
2) Contour Interval : 1.0 m
3) Datum Elevation : Lowest Low Water Spring (LLWS) which was established by the result of tide observation at each terminal site was used as datum elevation for the mapping work.
4) Mapping Area : At least 200 m x 200 m
5) Bench Marks : Two (2) bench marks were established for each terminal site. The locations and elevations of bench marks are listed in the table below.

6) Survey Method : Traverse survey and height difference measurement.

Table 2-2-1 Bench Marks

Location	Bench Mark	Local Coordinates		Elevation
		East	North	
Mokmer	BM 0 BM 1	5,000.000 5,122.200	5,000.000 5,087.220	3,917 3,920
Saubeba	BM 0 BM 1	5,000.000 4,740.703	5,000.000 5,119.904	2,937 3,314
Terong Wai-werang	BM 1 BM 2	5,000.000 5,086.000	5,000.000 5,008.112	5,292 5,477
Lewoleba	BM 0 BM 1	4,902.503 5,000.000	5,021.510 5,000.000	3,204 3,050
Bajoe	BM 0 BM 1	5,000.000 4,933.113	5,000.000 5,001.519	3,168 3,161
Kolaka	BM 0 BM 1	5,000.000 4,972.350	5,000.000 5,115.594	2,937 2,956
Palembang	BM 1' BM 2	5,055.757 5,000.000	4,979.715 5,000.000	2,847 2,902
Muntok	BM 1 BM 2	5,000.000 5,058.513	5,000,000 4,947.506	4,659 4,907

3. Mokmer Site is now utilized privately as fish breeding ponds. Therefore, reclamation work is necessary for construction of the on-land facilities of the new ferry terminal. The material for reclamation will be obtained by dredging the harbour basin.

4. Saubeba Site is covered by wild woods. Thus the terminal site must be prepared by cutting trees and grading land.

5. Terong Waiwerang Site and Lewoleba Site are flat but are located on a narrow space between the existing road and the coast. Therefore, foreshore reclamation work is required to obtain enough land area for the terminal facilities.

6. In Bajoe Site, the existing on-land facilities are located 3 km away from

the mooring facility. This is inconvenient for passengers. There is at off-shore shoal near the mooring facility. Therefore it is planned to construct the new on-land facilities on reclaimed land at the shoal. The material for reclamation will be brought from the mountains because the seabottom soil around the shoal is very soft and not suitable for reclamation.

7. Kolaka Site has no space for on-land facilities for the ferry terminal. Therefore, required land space should be obtained by reclamation of foreshore. The material for reclamation is easy to obtain from the mountains around the city.

8. The existing Palembang terminal has enough space for expansion of on-land facilities but the existing space for the expansion is low lying and land fill of approximately. 1.0 m depth is necessary.

9. Muntok Site is flat and of suitable elevation. Only several coconut trees must be removed for construction of the on-land facilities.

10. The results of the topographic survey are shown in Fig.2-2-1A to Fig. 2-2-10A in Part 3 of the Appendix.

2-3 Hydrographic Conditions

11. A hydrographic survey was conducted simultaneously with the topographic survey using the following criteria.

1) Mapping Scale	:	1 : 500
2) Contour Interval	:	1.0 m
3) Datum Elevation	:	LLWS
4) Sounding Pitch	:	10 m
5) Sounding Area	:	500 m x 500 m in general
6) Survey Method	:	Depth survey by echo sounder and positioning by theodolites or sextants.

12. Mokmer Site is located on a coral reef. The seabottom to -1.0 m is very gentle sloping but below -1.0 m to -20 m is very steep sloping. The site is open to south-west waves of maximum height more than 2 m. Therefore, a

breakwater is needed for this mooring facility. Judging from the hydrographic conditions of this site it is preferable that the mooring facility is built in the basin which would be obtained by dredging the coral reef, protected by the breakwater.

13. Saubeba Site is in a small bay but the bay is not protected enough against easterly and westerly waves. Therefore, it is recommended to construct breakwaters on the shoal at two sides.

14. Terong Waiwerang Site and Lewoleba Site are located at calm sea areas. The slopes of the seabottom are relatively steep at both sites. From the view point of construction cost, therefore, the mooring facilities should be built parallel with the contour lines.

15. Bajoe Site has shallow water and the seabottom slope is very gentle. Thus, the existing mooring facility is situated at a water depth of -3.0 m and around 3 km from the shore. The new mooring facility requires a water depth of -4.0 m which means that the mooring facility should be located around 500 m further offshore from the existing mooring facility, otherwise dredging work is unavoidable.

16. Kolaka Site is also very gentle sloping to -2 m, but differs from Bajoe Site in that a water depth of -4.0 m for the new mooring facility is obtainable near the existing mooring facility.

17. Palembang Site is situated on Musi river approximately 80 km from the estuary. This river has water depth of more than -20 m around the terminal site. The required water depth for the new mooring facility is -3 m which is obtained at 30 to 40 m from the river bank.

18. Muntok Site has a relatively steep sloped seabottom and the required water depth of -3 m is obtained at 50 to 60 m from the shore line. The seabottom slopes down to -15 m at first, after that it slopes up to -4 m, then slopes down again. However this configuration does not cause any problems for the ferry operation.

19. The results of the hydrographic survey are illustrated in Fig. 2-2-1A to Fig. 2-2-10A in Part 3 of the Appendix.

2-4 Tide

20. Tide observations were carried out for 15 days continuously at each terminal site from September to November, 1992. Based on the observation data, tidal constituents were obtained by harmonic analysis as shown in Table 2-4-1.

Table 2-4-1 Tidal Constituents

Constituent	Mokmer	Saubeba	Terong	Lewoleba	Bajoe	Kolaka	Palembang	Muntok
M_2	0.421	0.416	0.672	0.441	0.561	0.456	0.261	0.359
S_2	0.107	0.141	0.393	0.266	0.182	0.208	0.083	0.136
K_1	0.206	0.193	0.278	0.279	0.280	0.285	0.636	0.943
O_1	0.133	0.140	0.169	0.181	0.200	0.199	0.528	0.634
P_1	0.068	0.064	0.092	0.092	0.093	0.094	0.211	0.312
N_2	0.053	0.047	0.120	0.040	0.119	0.217	0.026	0.048
K_2	0.029	0.038	0.107	0.072	0.050	0.056	0.022	0.037
M_4	0.002	0.009	0.005	0.018	0.021	0.011	0.023	0.028
MS_4	0.006	0.006	0.010	0.023	0.031	0.018	0.029	0.012

21. The tide is classified by diurnal, semi-diurnal and mixed semi-diurnal type according to the so-called form number. The tide types at each terminal site are as shown in the table below.

Table 2-4-2 Type of Tide

Location	Form Number	Type of Tide
Mokmer	0.642	Mixed Semi-Diurnal
Saubeba	0.598	Mixed Semi-Diurnal
Terong Waiwerang	0.420	Mixed Semi-Diurnal
Lewoleba	0.651	Mixed Semi-Diurnal
Bajoe	0.641	Mixed Semi-Diurnal
Kolaka	0.730	Mixed Semi-Diurnal
Palembang	3.390	Diurnal
Muntok	3.186	Diurnal

22. From the harmonic analysis of the tide data, the significant tide levels in each terminal site are as follows.

Table 2-4-3 Significant Tide Level

	Mokmer	Saubeba	Terong	Lewoleba	Bajoe	Kolaka	Palembang	Muntok
H.H.W.S	1.55	1.59	2.95	2.14	2.32	2.53	2.92	4.12
M.S.L	0.92	0.92	1.51	1.19	1.32	1.46	1.44	1.89
L.L.W.S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

23. Palembang Site is situated about 80 km from the estuary. In this case, water level is affected not only by tide but also by upstream discharge. Therefore, the results of harmonic analysis at that location are valid only for the same run-off discharge. On the other hand, Palembang Sea Port is near the ferry terminal site and the significant tide levels of the sea port have been established based on data obtained over a long period. Accordingly the significant tide levels of Palembang Sea Port should be utilized for the design of the ferry terminal.

Significant Tide level of Palembang Sea Port

H.H.W.L	4.10 m
H.W.L	3.70 m
M.S.L	2.05 m
L.W.L	0.50 m
L.L.W.L	0.00 m

2-5 Current

24. Observations of the current were executed at each terminal site according to the following criteria.

1) Location : Two (2) locations at each survey site.
2) Layer : Two (2) layers (surface layer and bottom layer) at each location.
3) Observation Timing : Around the times of spring tide and neap tide.
4) Observation Period : 25 hours continuously.
5) Observation Method : Direct reading current meter.

Two (2) minutes measurement every 15 minutes interval.

25. The maximum velocity of the current at each site are presented in the table below. The observations show that ship maneuverability at all the terminal sites is not adversely affected by the current.

Table 2-5-1 Current Velocity

Location	Tide	Max. Velocity (m/sec)	Direction
Mokmer	Flood Ebb	0.65 0.50	ENE WSW
Saubeba	Flood Ebb	0.58 0.38	W E
Terong Waiwerang	Flood Ebb	0.26 0.25	WNW E
Lewoleba	Flood Ebb	0.80 0.70	WSW E
Bajoe	Flood Ebb	0.35 0.28	NW SWS
Kolaka	Flood Ebb	0.28 0.27	SWS NEN
Palembang	Flood Ebb	0.14 0.54	S N
Muntok	Flood Ebb	0.52 0.69	E SW

2-6 Wave

26. Waves in Mokmer, Saubeba and Muntok sites will affect the ferry operation but no wave data were available. Therefore, waves in these sites are forecast from the wind data over a period of more than 10 years.

27. Summary tables of wind data for wave analysis are shown below.

Table 2-6-1(1) Frequency of Occurrence of Wind

Location : Mokmer, Biak, Irian Jaya
Data Year : 1977-1990
Meteorology Station : Station Mokmer, Biak
Elevation above MSL : 10m

Unit : %

Direction	Velocity (m/sec)							
	Calm	1 - 3	3 - 5	5 - 7	7 - 9	9-11	> 11	Total
-	-	-	-	-	-	-	-	-
North	-	1.64	5.89	3.56	0.38	0.10	-	11.57
North East	-	0.65	1.85	1.54	0.34	0.07	0.07	4.52
East	-	0.96	5.68	6.26	2.70	0.55	0.07	16.22
South East	-	0.65	3.22	1.54	0.07	0.10	-	5.58
South	-	2.43	2.67	0.89	0.34	0.24	-	6.57
South West	-	1.68	4.62	2.74	0.99	0.27	0.10	10.40
West	-	2.29	13.66	14.00	3.63	1.06	0.58	35.22
North West	-	1.30	5.17	2.87	0.44	0.10	0.03	9.92
Total	0.00	11.60	42.74	33.40	8.90	2.50	0.86	
Cumulative	0.00	11.60	54.35	87.75	96.65	99.14	100.00	100.00

Table 2-6-1(2) Frequency of Occurrence of Wind

Location : Sabueba, North Yapen, Irian Jaya
Data Year : 1977-1990
Meteorology Station : Station Mokmer, Biak
Elevation above MSL : 10m

Unit : %

Direction	Velocity (m/sec)							
	Calm	1 - 3	3 - 5	5 - 7	7 - 9	9-11	> 11	Total
-	-	-	-	-	-	-	-	-
North	-	1.64	5.89	3.56	0.38	0.10	-	11.57
North East	-	0.65	1.85	1.54	0.34	0.07	0.07	4.52
East	-	0.96	5.68	6.26	2.70	0.55	0.07	16.22
South East	-	0.65	3.22	1.54	0.07	0.10	-	5.58
South	-	2.43	2.67	0.89	0.34	0.24	-	6.57
South West	-	1.68	4.62	2.74	0.99	0.27	0.10	10.40
West	-	2.29	13.66	14.00	3.63	1.06	0.58	35.22
North West	-	1.30	5.17	2.87	0.44	0.10	0.03	9.92
Total	0.00	11.60	42.74	33.40	8.90	2.50	0.86	
Cumulative	0.00	11.60	54.35	87.75	96.65	99.14	100.00	100.00

Table 2-6-1(3) Frequency of Occurrence of Wind

Location : Muntok, Bngka
Data Year : 1978-1988
Meteorology Station : Station Pangkal Pinang
Elevation above MSL : 33m

Unit : %

Direction	Velocity (m/sec)							
	Calm	1 - 3	3 - 5	5 - 7	7 - 9	9-11	> 11	Total
-	0.14	-	-	-	-	-	-	0.14
North	-	0.52	6.11	5.26	1.07	0.08	-	13.04
North East	-	0.30	3.70	3.83	0.82	0.14	-	8.79
East	-	0.63	10.60	12.11	1.07	0.05	-	24.46
South East	-	0.44	5.51	7.89	2.00	0.08	-	15.91
South	-	1.23	8.98	7.61	1.45	0.08	0.03	19.39
South West	-	0.19	1.51	0.88	0.22	0.03	-	2.82
West	-	1.42	6.90	2.52	0.41	0.03	-	11.28
North West	-	0.52	2.22	1.21	0.19	0.03	-	4.16
Total	0.14	5.26	45.52	41.30	7.23	0.52	0.03	
Cumulative	0.14	5.40	50.92	92.22	99.45	99.97	100.00	100.00

28. From the above wind data, the design waves for each terminal have been determined as follows.

Table 2-6-2 Design Wave

Location	Wave Height H 1/3 (m)	Wave Period T 1/3 (Sec)	Direction
Mokmer	3.00	4.8	WSW
Saubeba	3.00	4.2	W
Muntok	1.00	4.0	SSW

2-7 Soil

29. In order to establish the sub-soil conditions, one (1) boring for the on-land facilities area and one (1) boring for the mooring facility area were executed at each terminal site.

30. The sub-soil in Mokmer Site is medium to dense white sand with coral. The specific gravities vary between 2.73 and 2.79, and N values vary from 10 to 50. The bearing layer for pile foundation appears about 13 to 15 m below the surface.

31. The on-land sub-soil 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, which has N-values more than 30. The surface layer of off-shore sub-soil is medium dense sandy gravel about 3 m thick. Below this, medium to dense white sand with coral layer is observed. The bearing layer for pile foundation appears around 15 m below the seabottom.

32. The sub-soil in Terong Waiwerang Site consists of very dense sandy gravel and gravelly sand. The boring logs both on-land and off-shore could obtain a depth of less than 10 m. Therefore, gravity type foundation is recommended for this terminal.

33. The sub-soil in Lewoleba Site consists of medium to dense black sand and gravelly sand. N-values are very variable (from 6 to 69) up to 25 m below the surface. Below this depth N-values are more than 50 continuously.

34. The on-land facility area is covered by loose to medium dense grey sand with a coral layer 2 to 3 m thick. Underneath this, there is soft to hard whitish yellow lime stone of which the N-values vary from 16 to more than 100. However the off-shore facility area is covered by a loose grayish brown silty clay layer about 5 m thick. Under this layer a lime stone layer is observed with N-values of 12 in its upper layer and more than 40 at 25 m below the surface.

35. The sub-soil in Kolaka Site is very poor at both the on-land facility area and the off-shore facility area. The sub-soil consists of loose to medium grey silty sand with N-values of 2 to 14. Two (2) borings were executed to 30 m below the surface, however, a suitable bearing layer for pile foundation or gravity type foundation could not be discovered. Therefore, friction piles should be used for the foundation of the mooring facility and the passenger terminal building.

36. The surface layer of sub-soil at the Palembang Site is about 6 to 9 m thick of very soft brownish grey silty clay with N-values of zero. Under the surface layer a soft grey clayey sand layer about 10 m thick appears but this layer has not enough strength for the foundation. The third layer is gray fine sand with N-values of 30 to 57 and could be the bearing layer for foundation piles.

37. The sub-soil of the on-land facility area in Muntok Site is quartz sand more than 9 m thick and N-values mostly more than 40. However, the sub-soil of the off-shore facility area consists of four (4) layers. The first layer is 2 m thick soft grey sandy clay and the second layer is 12 m thick very soft grey clay of which the N-values are zero. The third layer is 2.5 m thick brown sand with N-values of 50 and the fourth layer is sandy gravel with N-values of more than 50. Accordingly, the on-land facilities do not need any foundation piles while the off-shore facilities should be supported by pile foundations.

38. The sub-soil profiles of each terminal site are shown in Fig.2-7-1A to Fig. 2-7-8A in Part 3 of the Appendix.

Chapter 3 Forecast of Ferry Transportation Demand for Short Term Plan

3-1 Future Socioeconomic Framework

3-1-1 Population

1. In forecasting future population growth we use the growth rate of REPELITA V(Future 5 Years Plan). The growth rate of population in Indonesia has shown a tendency to decrease, 2.23% in 1971-1980 and 1.97% in 1980-1990. According to the projections by the Demographic Institute, the growth rate of national population is forecasted as follows;

1990-1995 1.64% 1996-2000 1.43%

2001-2005 1.19% 2006-2010 1.04%

2. Concerning the area in which F/S routes are located, except Irian Jaya and Southeast Sulawesi, the same tendency prevails. We therefore decrease the growth rate in these areas at the same rate as the national population. Concerning Irian Jaya and Southeast Sulawesi Province, we use the growth rate of REPELITA V until 2000.

3. The adopted population growth rate of each province and the future population in 1998 can be calculated based on these rates as follows;

Province	Growth Rate 1990-1995	Growth Rate 1996-2000	Population in 1998 (thousand persons)
Maluku	2.45%	2.13%	2,234
East Nusa Tenggara	2.10%	1.83%	3,830
South Sumatra	2.70%	2.35%	7,689
Irian Jaya	2.97%	2.97%	2,074
Southeast Sulawesi	3.08%	3.08%	1,721

3-2 Population in the Hinterland of Feasibility Routes

4. In deciding hinterlands, the Study Team selects those areas which will be served by the related ferry route on the island or kecamatan level. Small

islands and towns generally depend on nearby big cities for their daily necessities.

5. Population in the hinterland of feasibility routes to be used for forecasting future demand is as follows:

	Proposed Site	Hinterland	Population(1990)
No.2-1	Mokumer	Biak Is.	75,343
	Saubeba	Yapen Is.	50,766
No.3-1	Larantuka	Larantuka	33,562
		(Kupang	522,944)
	Terong	Adonara Is.	83,439
No.3-2	Larantuka	Larantuka	33,562
		(Kupang	522,944)
	Lewoleba	Lomblen Is.	84,875
No.8	Bajoe	Ujungpandang,Bone	1,523,198
	Kolaka	Kendari,Kolaka	728,074
No.9-1	Palembang	Palembang	1,144,279
	Muntok	Bangka Is.(Part)	445,351

6. Concerning route No.2-1, we select the island in which proposed sites are located as the hinterland. At present conventional ship service between Biak and Serui, which is the main city in Yapen Is., is operated in the western sea of Yapen Is. Ships dock at the south side of Yapen Is. The navigating distance is, therefore, very long. However a road connecting Saubeba and Serui is under construction. Upon completion, the ships will be able to dock directly at the north side of Yapen Is. and the navigating distance will be greatly reduced. The road is planned to be completed by 1998, at which time accessibility between Biak Is. and Yapen Is. will be greatly improved.

7. Concerning route No.3, Adonara Is. and Lomblen Is. depend on Larantuka because the main ferry service is between Kupang, which is the capital of East Nusa Tenggara Province, and Larantuka. In forecasting future demand, we include Kupang as the hinterland in this route. Population of the islands in this region is comparatively large and these islands are located at the edge of the main ferry network of Indonesia, which connects the Greater and Lesser Sunda Islands in

series from Sumatra to Timor. In this route, a large demand is expected in the future though at present demand depends on Kupang.

8. Route No.8 is mainly used as the connection with Ujung Pandang and Kendari which are the capitals of Southeast Sulawesi and South Sulawesi Province respectively. Therefore we select the hinterland as follows: Ujung Pandang and Bone in Bajoe site and Kolaka and Kendari in Kolaka site.

9. Concerning Muntok site of route No.9-1, we select the northeast part in Bangka Is., in which Pangkalpinang, Sungairiatto and Belinyu are located, as the hinterland. This area holds 75% of the population of Bangka Is.

3-3 Demand Forecast

3-3-1 Elasticity

10. As mentioned in Chapter 3 in Part 2, 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 among the various transportation systems.

(1)Passenger

11.	All Ferry Routes(1984-1990)	2.0
	All Transportation Means(1986-1990)	1.2
	(Ferry, Conventional ships, Railway and Air)	
	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

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

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

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

3-3-2 Passenger

(1) Existing Routes

13. The past data accurately reflects the general characteristics and the trend of social/economic activities in the related hinterlands. Concerning the existing routes, therefore, the past data is used to predict future passenger traffic with some adjustment for elasticity.

14. The result in calculating future passenger is as follows:

	1990	1998	1998/1990
Route No.8	305,000	520,000	1.7
Route No.9-1	81,000	190,000	2.3

15. In Route No.8, passenger volume will increase to 520,000 or by 1.7 times compared to 1990. As service frequency is 6trips/day on this route, in 1998 the average passenger volume is 240 per trip.
In Route No.9-1, passenger volume will increase to 190,000 or by 2.3 times compared to 1990. The distance of Route No.9-1 will be shortened by moving the ferry terminal and demand potential is very high with Palembang as the hinterland. After improving the ferry terminal, the growth rate will be high with sufficient operation.

(2) New Routes

16. There are conspicuous differences in the characteristics between day trip routes and the other routes. Considering the differences in the characteristics between day trip routes and the other routes, we therefore divide the existing routes into two groups depending on length. 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. The parameters are decided by recurrent analysis of the existing routes in 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

17. The results using the formula are as follows:

Route No.2-1	Mokumer - Saubeba	67,000
Route No.3-1	Larantuka - Terong	62,000
Route No.3-2	Larantuka - Lewoleba	62,000

18. Concerning route No.2, a passenger ship(1,400 ton) has been operated between Jakarta and Jayapure once a month from May in 1991 and it is calling some ports in Irian Jaya province. There are not so many passengers among Biak, Yapen and Nabire, 240 on average. As the number of travel hours will be reduced when docking becomes possible directly at the south side of Yapen Is. and as the ferry service frequency in general improves, passenger demand is expected to increase. According to the forecast, the number of passengers is projected to reach 180 per day in 1998.

19. Concerning route No.3, most of the flow of passengers and cargoes from Kupang by existing ferry service stop at Larantuka. As ferry service frequency is only twice a week and fare is high, there are not many passengers between Larantuka and Terong, Lewoleba. Moreover, if a ship requires repair, the trip between Larantuka and Terong, Lewoleba is canceled. Inhabitants moved between islands mainly by small ships with a capacity of 50 passengers operated by regional people. Fare is cheap and service frequency is twice a day. These

small ships, however, can not transport many cargoes and cars, which impedes development of the islands. Adonara Is., which contains Terong, and Lomblen Is., which contains Lewoleba, have more than 80,000 inhabitants respectively and development potential in these islands is high. With the improvement of ferry service, big demand is expected in these areas.

20. Because of the present situation mentioned above, to forecast future demand based on past data would not accurately show the characteristics in these routes. We therefore forecast future demand based not on past data but rather the aforementioned formula for the new route.

21. These routes play a role in connecting Larantuka, Terong, Lewoleba and Kupang, which is capital of East Nusa Tenggara province. The social/economic activities of Larantuka, Terong and Lewoleba mainly depend on Kupang. In conducting demand forecast for route No.3, we include the demand forecast between Kupang and Adonara, Lomblen. According to the forecast, the number of passengers are projected to reach 160 per day in 1998.

3-3-3 Cargo

22. By calculating the basic unit value to show the average cargo demand level by ferry in proportion to the scale of social/economic activities in the related region, we forecast cargo volume transported on the new routes. 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.

23. Concerning Bajoe-Kolaka route (Route No.8), cargoes are mainly transported by big trucks unlike the other routes. The basic unit value on this route based on the past data is about 0.06.

24. Palembang-Bangka route (Route No.9-1, 74 miles) is classified as a "Regional Trunk Route" and plays an important role in this area. The present operation is not sufficient due to influence of tide and fog, in 1991, due to a decline in the number of trips, passengers decreased by half compared to that in 1989. Express passenger boats and general cargo ships are operated besides existing ferry service and some of the ferry passengers are considered to have moved to these ships. Regardless of this situation, cargo volume transported by

ferry has increased steadily. General cargo ships are not Ro/Ro type so that the transport of cargoes still depends on ferry. In this area the standard of living is high compared to other areas in eastern Indonesia and demand potential for daily activities is very high with Palembang as the hinterland. After improving the ferry terminal in Muntok, ferry service will be punctual and travel time will be shortened. In future, many passengers/cargoes are expected to be transported on this route, therefore, we apply the basic unit value of routes shorter than 50 miles(0.03) on this route.

25. The results of the future cargo forecast are as follows:

	1990	1998	1998/1990
Route No.2-1	-	2,900	
Route No.3-1	-	3,600	
Route No.3-2	-	3,400	
Route No.8	36,000	83,000	2.3
Route No.9-1	2,500	21,000	8.4

26. Concerning the new routes, in 1998 cargo demand will approximately be equivalent to that of Meulaboh - Sinabang route (2,534ton in 1989, 2,144ton in 1990, 3,254ton in 1991).

27. Concerning route No.9-1, cargo volume will increase to 20,000 or by 8.4 times compared to 1990. This route is classified as a "Regional Trunk Route" and the distance of this route will be shortened and punctuality will be maintained by moving the ferry terminal. After improving the ferry terminal, with sufficient operation, the growth rate will be high.

3-3-4 Vehicle

28. 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 ratio of large-size trucks is exceptionally high. Based on the past data, the average load per truck is assumed to be 75% for an 8-ton truck (6.0 tons) on this route.