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

30. The results of the vehicle forecast are as follows:

4-Wheeled-Vehicles (unit)

	Trucks	Passenger Cars
No.2-1 Mokumer-Saubeba	1,400	1,900
No.3-1 Larantuka-Terong	1,700	1,900
No.3-2 Larantuka-Lewoleba	1,600	1,900
No.8 Bajoe-Kolaka	14,000	15,000
No.9-1 Palembang-Bangka	10,000	5,500

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

32. The results are as follows:

	2-Wheeled-Vehicles (unit)
No.2-1 Mokumer-Saubeba	3,000
No.3-1 Larantuka-Terong	2,300
No.3-2 Larantuka-Lewoleba	2,300
No.8 Bajoe-Kolaka	9,000
No.9-1 Palembang-Muntok	9,000

Chapter 4 Short-term Ferry Operation Plan

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

4-1-1 Criteria for Selection of Optimum Ferryboat on each Route

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

1. The INTERIM REPORT provided details of weather/sea conditions for the entire Indonesian Sea Area by referring to INDONESIAN PILOTS published by HYDROGRAPHER of the NAVY.

Based on the above mentioned documents and related information obtained from local inhabitants during the field survey, we assumed the possible hostile weather/sea conditions of each route during a normal year. Selection of an appropriate ferryboat from five models shall begin by first establishing whether she is seaworthy against the above assumed natural conditions of the route.

Needless to say, the seaworthy ferryboats should be in compliance with the laws and regulations in force concerning ferryboats and their operation in this country.

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

2. Besides weather/sea conditions, we give consideration and refer to the following matters in selecting the appropriate ferryboat, providing facilities and planning ferry operation.

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

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

3. A ferryboat to be introduced in any of the given route should be able to meet the traffic demand of the route. We selected the appropriate ferryboat by route based on the estimated traffic demand of each route in 1998.(see chapter 3) When different types of ferryboats are selected based on each of the standard(natural conditions and traffic demand), the larger one should be selected as the optimum ferryboat of the route.

4-1-2 Planning Method for Frequency of Round Trip of Ferryboat

4. The required frequency of round trip per day on a given route in 1998 can be estimated using the traffic demand of passengers and cargoes, respectively.

1) For cargo traffic

Assumed conditions are as follows:

a. Estimated total volume of cargoes in 1998 by routes:P(see chapter3)

b. Type of trucks to be carried

Route 8: 8ton

Route 2,3,9: 4ton & 2ton 50% each

c. Average loading ratio of a truck

Route 8: 75% (from past record)

Route 2,3,9: 70%

d. No. of trucks to be carried through the year: N_T

Route 8: $N_T = P/(8 \times 75\%)$

Route 2,3,9: $N_T = P/(3 \times 70\%)$

e. No. of sedans to be carried through the year: N_S(see chapter 3)

f. Convert N_S into No. of trucks according to the deck space ratio of cars: $N_{T'}$

$N_{T'} = N_S \times$ deck space ratio

8^t Truck: 25

4^t Truck: 19

2^t Truck: 9.5

3^t Truck: (19+9.5)/2 = 14.3

g. Total number of cars converted into trucks to be carried in the target year(1988) by routes: N

$N = N_T + N_{T'}$

h. The required frequency of round trip per day for cargoes: F_C

$$F_C = \frac{N}{365 \times K \times O \times M}$$

K: Net operation ratio of a ferryboat through the year excluding suspended service mainly due to docking = 0.9

O: Average car loading ratio per trip = 0.6

M: Maximum car loading capacity by type of ferryboat

Type	8^t-T	4^t-T	2^t-T
A	27	36	72
B	15	20	40
C	-	15	30
C'	-	14	28
D	-	9	18

2) For passenger traffic

The required frequency of round trip per day for passengers: F_P

$$F_P = \frac{N'}{365 \times K \times O' \times M'}$$

K: 0.9(as above defined)

N': Estimated total number of passengers through the year(see Chapter 3)

O': Average passengers occupation ratio per trip = 0.6

M': Maximum capacity of passenger by type of ferryboat

Type of Ferryboat	Passenger Capacity
A	600
B	500
C	300
C'	300
D	150

5. Consequently, the practical service frequency of a given route should adopt the higher one of the two estimations, F_C or F_P.

In addition to this, the frequency and time zone of the service should, as far as practicable, comply with user's convenience e.g.:

* Planning daytime service in principle from the viewpoint of navigation safety,
* Maintaining minimum service frequency of once a week,

* Connecting with existing ferry service,
* Considering the time required between a terminal and users' origins or destinations,
* Planning a favorable time zone for users.

4-2 Detailed Operation Plan

4-2-1 Biak(Mokmer) - Yapen(Saubeba) Route

6. **Local weather/sea conditions** In this region winds rather than temperature mark the change of seasons -- the prevailing winds change from the NW monsoon(November - March) to the SE monsoon(May - September).

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

During the NW monsoon the wind is usually very strong; repeated heavy W'ly squalls called **"Wamanda"** by the Papuans, come almost unexpectedly from W and WSW on the S coast of the Biak, and from a more N'ly direction on the N coast. (from INDONESIAN PILOT published by HYDROGRAPHER of the NAVY)

In addition to the above, we obtained the following information from local inhabitants during the field survey;

* a captain of a 200GRT cargo boat trading between Jayapura, Serui and Biak for years has warned us that maneuvering a vessel alongside a jetty on the N coast of Yapen would be particularly difficult under a freshened **"Barrat"** (W'ly wind) in November through March,
* the "Kepala disa" of Yobi explained that the height of highest wave attacking the beach of Yobi reaches two to three meters during **Barrat** prevailing season (November to March) and continues for seven to ten days.

7. Summing up this weather/sea information, and considering that both terminal sites are situated along flat coasts facing the open sea of Selat Sorenarwa, the operator of ferryboat should take heed of the sudden change in weather though it is only applied to about 20% of the days in a normal year.

According to conventional wisdom, a vessel should not arrive/leave a jetty during the wind of more than 10m/s without a tug boat. In Mokmer terminal during both prevailing monsoons and in Saubeba terminal in the NW monsoon season particularly it should be cautiously conducted to dispatch a ferryboat.

Although poor visibility owing to fog is very rare in these seas, strong winds, frequently accompanied by heavy showers of rain, occur almost throughout the year and occasionally reduce visibility to below 1,000m; due caution for poor visibility should also be taken.

The weather data obtained from Biak Harbor master Office is shown in Table 4-2-1A.

8. **Traffic demand** We have estimated the traffic demand of this route in 1998 and obtained the results as shown in chapter 3. 3-3.

After conversion into service frequency by a 300GRT ferryboat with the aforementioned method in par.4, the net daily service frequency for passengers is 0.6, while it is 0.4 for cargoes(cars).

According to information from an official of Serui concerned with local transport, the road between Serui and Saubeba is scheduled to be completed within the 93-94 fiscal year, then a consistent traffic route by car and ferryboat between Serui and Biak promises more convenient transport and rising traffic demand.

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

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

In view of the fact that ferryboats transport a lot of human lives and property, they should have necessary and sufficient equipment as stipulated in SOLAS and maritime laws/regulations concerned. Life saving, fire-fighting, radar and communication apparatuses are particularly indispensable.

And, needless to say, the depth of the turning basin should be maintained

3m below the chart datum for this type of ferryboat.

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

However, the C type ferryboat(11kt) won't be able to be placed on this route when the traffic demand rises and two round trips per day are required; thus we recommended the C' type ferryboat(14kt) instead in THE MASTER PLAN study.

10. **Timetable of ferry operation** Information required in planning the time table is as follows;

* ferryboat: C(300GRT),
* service frequency: one round trip per day,
* distance/time required for single voyage: 31'/3h-30min.,
* time zone of service : daytime sailing,
* terminal to/from user's origin/destination: Sabueba to Serui - 34km.

A model time table is shown in Fig. 4-2-1A.

4-2-2 Larantuka - Terong - Lewoleba Route

11. **Local weather/sea conditions** No weather warning to vessels sailing on these sea areas is found in THE INDONESIAN PILOT. A resident official at the port of Terong attests to the sea calmness in the vicinity of Terong. A local inhabitant at Lewoleba explained that the winds freshen in February through March from various directions and several small crafts have sunk off Tg.Lowukuma(the narrowest passage of the Lamakera Strait).

Putting information together on weather/sea of this sea area, more attention should be paid to the problematic tidal streams than winds. The strongest tidal streams are found in the narrow close under Tg. Watu Wako, where a rate of five knots was previously observed two days after spring tides, and it may thus be assumed that the maximum rate there may reach seven knots. During our field survey, we experienced a strong eddy off the bight on the SE coast of Pulau Adonara, a junction where streams from three straits of Solor, Lamakera and Boling converge.

12. **Traffic demand** We have estimated the traffic demand of this route in

1998 and obtained the results as shown in chapter 3. 3-3.

After conversion into service frequency by a 300GRT ferryboat with the aforementioned method in par.4, the required frequencies of round trip per day for passengers and cargoes are as follows;

Table of required service frequency

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

To meet the existing traffic demand in this route, an irregular ferry service is being provided by one of the ferryboats trading between isolated islands in Savu Sea and Kupang, a hub of ferry service in the West Timor, that is, while four ferryboats sailing on the above lines, one of the ferryboats extends her service from Larantuka to Lewoleba via Waiwerang once a week. However, if there are only three ferryboats sailing due to the docking of a ferryboat, the extended service is suspended. When no ferry service is available between Larantuka and Lewoleba, the daily traffic service will be maintained only by local conventional small crafts.

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

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

Although rather strong tidal streams in these sea areas are reported, the above ferryboat, power-driven with a steel hull has sufficient seaworthiness. The equipment to be installed in the ferryboat and necessary conditions for her turning basin are the same as mentioned in par. 10.

The sailing time required by the above ferryboat would be 1h-40min. for 14' of Larantuka to Terong, and 1h-50min. for 17' of Terong to Lewoleba, respectively. The ferryboat may thus be able to sail a round trip within nine to ten hours including the loading/unloading works at terminals to meet the estimated traffic demand.

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

14. **Timetable of ferry operation** Required information for planning the timetable is as follows;

* ferryboat: C(300GRT),
* service frequency: one round trip per day,
* distance/time required for single voyage: 30'/3h-30min.(exclude staying hours),
* time zone of service: daytime sailing,
* connection to existing service bounding for Kupang: 14:00 of two days per week.

A model timetable is shown in Fig. 4-2-2A.

4-2-3 Bajoe - Kolaka Route

15. **Local weather/sea conditions** The route connects either coast of Bone Bay almost paralleling to lat.$4^{d.}$-$30^{m.}$S close to the equator.
Situated in the calm belt known as Doldrums, no particular weather warning is found in the INDONESIAN PILOT. An official of Bajoe Harbor Office stated that ever since the first sail of ferryboat on this route in 1978 no suspended service has been experienced due to rough weather.
While at Kolaka side, we obtained the maximum wind data of W'ly 15m/s in January through March from the Sea Port Office there.

The meteorological data obtained from Kolaka Sea Port Office is shown in Table 4-2-2A.

16. Tidal streams in Teluk Bone. Little is known of the horizontal movement of the water in Teluk Bone, but it appears to consist merely of weak and irregular drifts of a more or less local nature. The direction of the current in S of the Teluk Bone is in accordance with the monsoon, being W-going from June to October, and E-going from December to May.

Tidal streams set irregularly between the reefs in Teluk Mekongga. They set generally E and W in N of the islands. A S-going stream has been observed E of the islands and between Pulau Maniang and the coast. (INDONESIAN PILOT)

17. **Traffic demand** We have estimated the traffic demand of this route in 1998 as shown in chapter 3,3-3, and the result of rising demand is the most remarkable among the four study routes.

After conversion into service frequency by a 1,000GRT ferryboat with the aforementioned method in par.4, the required frequency of round trip per day for passengers and cargoes is as follows;

Table of required service frequency

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

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

18. **Ferryboats** The existing ferryboats under service are listed on the next page.

List of existing ferryboats under service

No.	Name	GRT	LOA (m)	Breadth (m)	Draft (m)	Sp'd (kt)	Capacity P.	C.	Built
1.	KMP.RACMAT BUHART	496	39.5	10.2	2.60	12.0	284	8	1977
2.	KMP.BANTEN	988	69.8	14.2	2.95	11-12	600	30	1966
3.	KMP.BONE RAYA	340	47.8	11.4	2.30	13.9	480	14	1969
4.	KMP.MERAK	510	45.8	11.3	3.20	10.0	447	18	1970
5.	KMP.EDHA	578	39.4	16.0	-	-	265	16	1967

Principal dimensions of the desired new ferryboat

No.	Name	GRT	LOA (m)	Breadth (m)	Draft (m)	Sp'd (kt)	Capacity P.	C.	Built
1.	KMP. "A"	1,000	70.0	14.0	3.50	16.0	600	27	-

Almost all existing ferryboats under service will be overaged in 1998, i.e., KMP.RACMAT BUHART(26Y), KMP.BANTEN(32Y), KMP.BONE RAYA(29Y), KMP.MERAK(28Y), and KMP.EDAH(31Y). Although the issue whether they are still seaworthy in 1998 depends largely on the judgment of government surveyors, replacement of a certain number of overaged ferryboats may have to be considered.

The desired type of ferryboat to replace existing ferryboats on this route and to meet the great potential traffic demand would be "A", regardless of the calm weather/sea conditions of the route.

19. **Timetable of ferry operation** Required information for planning the timetable is as follows;

* ferryboat: five existing ferryboats and an additional "A"(1,000GRT) type one,

* service frequency: five trips per day by five existing ferryboats and one round trip per day by an additional "A" ferryboat,
* distance: 80 miles,
* time required for single voyage excluding staying hours:
  8^h by five existing ferryboats,
  5^h-30^m by "A" ferryboat,
* time zone of service: five nighttime trips and one daytime round trip
* the terminals to/from users' origins/destinations:
  Ujung Pandang - Bajoe (190km/4-5 hours)
  Kolaka - Kendari (180km/4-5 hours)

A model timetable is shown in Fig. 4-2-3A.

4-2-4 Palembang - Muntoku Route

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

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 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 Gosang Amelia and Gosang 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 neighborhood 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.

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 half a 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. (from INDONESIAN PILOT published by HYDROGRAPHER of the NAVY)

In addition to the above, we obtained the following information from local officials of Harbor-master Office in Muntok: " the most hostile winds/seas on and around the sea front of Muntok are SE'ly ones, which are derived from the prevailing SE monsoon during May to September, and the highest wave reaches about two and a half meters on the front of port entrance, while the NW monsoon is lesser in effect than the SE monsoon".

21. **Traffic demand** The estimated traffic demand of this route in 1998 is shown in chapter 3 par. --, and after conversion into service frequency by a "B" type ferryboat(500GRT), the resultant number of trips are shown in the following table:

Table of required service frequency

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

Although daily one round trip service will be maintained on this route by the two existing ferryboats, their full transporting capacity will be insufficient in 1998 to meet the rising traffic demand.
The annual shortage of capacity will reach about 150,000 passengers, and 9,000 cars, thus, it is necessary to introduce an additional ferryboat to cope with the practical traffic situation.

22. **Ferryboat** The existing ferryboats under service are listed on the next page.

List of the existing ferryboats under service

No.	Name	GRT	LOA (m)	Breadth (m)	Draft (m)	Sp'd (kt)	Capacity P.	C.	Built
1.	KMP.MUSI RAYA	148	31.2	8.0	1.20	12.5	94	6	1979
2.	KMP.BANGKA RAYA	199	35.0	8.0	2.00	11.0	108	6	1970

Principal dimensions of the desired new ferryboat

1.	KMP. "B"	500	47.0	11.5	2.60	14.0	500	15

23. The two existing ferryboats under service will be overaged in the near future, that is, KMP.MUSI RAYA will be 19 years and KMP.BANGKA RAYA will be 28 years in 1998. Although replacement of the overage ferryboats depend exclusively upon the judgment of the government surveyors, the matter might also be considered by the implementation side.

Regardless that the weather/sea and Musi river conditions are fairly favorable for a smaller ferryboat, the "B" type(500GRT) ferryboat is recommended from the viewpoints of meeting the traffic demand and guaranteeing users' convenience on this route.

24. **Timetable of ferry operation** Required information for planning the timetable is as follows;

* ferryboat: two existing ferryboats and an additional "B"(500GRT) type one,
* service frequency: two trips per day by two existing ferryboats and one round trip per day by an additional "B" ferryboat,
* distance: 74 miles,
* time required for single voyage excluding staying hours:

8^h by two existing ferryboats,

6^h-30^m by "B" ferryboat,

* time zone of service: two nighttime trips and one daytime round trip,
* the terminal to/from users's origins/destinations: Paqngkalpinung (a densely populated district in Bangka) - Muntoku(130km/3^h)

A model timetable is shown in Fig. 4-2-4A.

4-3 Recommendation for Planning Navigational Aids

4-3-1 General

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

Normally, a vessel is capable of avoiding accidents through its own resources. Nevertheless, experience has shown that in certain cases "shore-based service" is required for assistance; for example, in approaching passages, in areas with a high traffic density, in channels, in circumstances where visibility is reduced and in difficult meteorological or hydrological conditions.

Thus, to ensure the greatest degree of safety and lighten the mariner's burden, with as little reform of natural conditions as possible, installation of the minimum essential navigationals aids should be considered.

4-3-2 Consideration of the Existing Situation of Navigational Aids.

26. During our field survey on the four study routes, we obtained data concerning the existing navigational aids, which are shown in Table 4-3-1A. Allocation of navigational aids such as lighthouses, Lateral Marks Leading-lights, Cardinal Marks, Isolated Danger Marks, Safe Water Marks etc are satisfactory on the Palembang Muntoku route only, and are rather lacking on the Bajoe Kolaka route, further, no type of navigational marks were observed on both the Mokmer Saubeba route and Terong Lewoleba route.

4-3-3 Necessary Navigational Aids at the New Terminals

27. Mokmer Saubeba Route

The port of Biak, thickly populated and the most important trading center of Biak Is. has general navigational aids such as two sets of leading lights and one mid-channel lighted mark.

However, Mokmer, the candidate ferry terminal, stands four miles ESE-ward from the center of Biak port without any navigation mark except a cliff prominent from E and a light for the use of aircraft installed in a white metal framework tower.

Although the intended ferry operation from/to Saubeba will be daytime service only, considering the frequent poor visibility caused by heavy rain in this district, a set of leading lights for the new jetty should be provided.

Furthermore, one set of lateral marks(port hand mark and starboard hand mark) should be provided to indicate the lateral limits of navigable passage between the shoals situated close to the site.

On the other hand, there are no navigational aids at the candidate terminal site of Saubeba. For the same reason aforementioned regarding Mokmer, one set of leading lights and one set of lateral marks should be provided to indicate the safe passage to the jetty between the two shoals extended on both sides of the bight.

Fitting lights and radar reflectors on those lateral marks are strongly desired.

28. Larantuka Terong Lewoleba Route

The existing ferry terminal of Larantuka stands two and a half miles W-ward of the port of Larantuka, the opposite shore of Wai Balon Is., and no navigation mark has been installed so far. Although the intended ferry operation is daytime service only, one set of leading lights for the new jetty should be provided.

The candidate ferry terminal site of Terong is next to a wharf known as the sea port of Terong which is used by inter-island vessels and no navigation mark has been installed. One set of leading lights for the new jetty should also be provided.

The candidate ferry terminal site of Lewoleba stands about 350m W-ward of the existing jetty for the inter-island vessels. One set of leading lights for the new jetty should also be provided.

29. Bajoe Kolaka Route

The ferry terminal of Bajoe stands about three km E off shore and is connected by a bridge from the town because the shallows extend far from the shore. In addition to the shallow, narrow and winding waterway, several shoals are scattered around the approach to the jetty; further, the existing nighttime ferry operation makes some navigating complex and problematic circumstances sometimes arise for the mariners.

Thus, in our view, there is room to create better waterway conditions through improvement of the navigation marks as follows;

* the following four damaged lateral marks should be replaced by lighted buoys fitted with efficient radar reflectors,
  - port hand mark(750m ESE off the jetty end)
  - starboard hand mark(1250m ENE off the jetty end)
  - starboard hand mark(2000m ENE off the jetty end)
  - starboard hand mark(Kr.Torea E)
* a lighted cardinal mark should additionally be installed at the W end of Kr.Totopala.

At Kolaka terminal side the following measures should be adopted to ensure navigation safety;

* replacement of the missing lateral mark of the Kr.Padamarang by a lighted mark fitted with an efficient radar reflector,
* a set of leading lights for the new jetty,
* installation of a new isolated danger mark on the Kr. Rosa Marie(04-05-30S,121-08-50E).

30. Palembang Muntok Route

The candidate ferry terminal of Muntok stands two miles W of the port of Muntok, at close range from Tg. Kelian Light House. Although the light house(a stone tower with the upper part red and the lower part white, 50m in height) is prominent from the sea, the following navigation marks should be provided;

* a set of leading lights for the new jetty,
* a set of lateral marks to indicate the navigable passage crossing

between Kr.Haji and rocky shoals extending ESE from it. Fitting with lights and radar reflectors on those marks is indispensable for the nighttime ferry service.

For Palembang ferry terminal, no additional or replacement of navigation mark will be necessary.

31. A table of navigational aids

Necessary navigational aids mentioned in par.27 to par.30 are summed up in the Table 4-3-2A.

Chapter 5 Short-term Ferry Terminal Plan

5-1 Basic Ideas for Ferry Terminal Development for Short-term Plan

(1) On-land Facilities of Ferry Terminal

1. On-land terminal area for passenger terminal and parking lots should be sufficient not only for short term plan but also for future expansion based on the Master Plan up to the year of 2010. However, according to the Master Plan, one berth is enough to meet the demand of cargoes and passengers in 2010 on the four study routes, although the number of trips on each route should be increased with the increase in demand. In that case, the sizes of passenger terminal and parking lot will be determined generally by the capacity of ferry-boat, that is, by the number of loading vehicles and the number of boarding passengers. Therefore, if the maximum ferry-boat to be introduced in 2010 is the same size as that in 1998, the expansion of the on-land terminal area in 2010 is not required.

   In case that ferry-boats successively arrive at and depart from the same berth and that the passengers to board and the trucks to be loaded on the incoming ferries arrive earlier at the terminal, the capacity of passenger terminal and parking lot should be increased.

2. A passenger terminal is planned to be at the shortest location to the mooring facilities as much as possible to minimize passengers' walking distance and time needed to board ferry-boat. A waiting parking lot is designed on the assumption that passengers generally use mini bus (its capacity is eight persons on average) as a public land transportation means from/to ferry terminal although a larger bus will be used for the transportation of passengers at Muntok, Bajoe and Kolaka terminal where the distance from the terminal to main cities of passengers' destination and origin such as from Bajoe to Ujung Pandang is considerable; thus an additional parking space for larger bus should be prepared.

3. It is recommended that because of the left side traffic rule for vehicles in Indonesia, a loading parking area be installed on the left side of the road leading from the entrance of a terminal to a berth to ensure a smooth flow of vehicles entering the parking lot and leaving for the berth. A loading parking

lot is prepared for trucks, passenger cars and motor cycles embarking on ferry-boat.

4. A main road in the terminal from the entrance to the passenger terminal is planned to be two-lane. It is essential to minimize the impact of vehicles from/to the terminal on the public road running behind the terminal to avoid congestion. In general, a ferry terminal is planned to have only one entrance/exit.

3-5m wide green-belts are planned to surround ferry terminals and parks are provided around terminal building on parking lots as much as possible if some space remains after the layout of main facilities has been determined.

(2) Breakwaters and Mooring Basin

5. Based on the natural condition survey for the Feasibility Study, breakwaters are required at Mokmer, Saubeba and Muntok. Generally, for structural type of breakwaters, rubble mound type should be applied; this type has been applied in many ports of Indonesia. However, the sea bed soil condition in Muntok have insufficient characteristics for the installation this type of breakwater and thus the curtain wall type is applied.

6. In all ferry terminals except Bajoe and Mokmer, mooring facilities are installed at the sea area with sufficient water depth for objective ferry-boat without dredging. Maximum size of ferry-boat to be operated in Bajoe-Kolaka route is 1000GRT and requires at least -4m water depth for sailing and berthing. -4m water depth contour in Bajoe is found about 400m from the tip of the existing mooring facilities. On the other hand, the distance between the new berth and the new passenger terminal should be minimized for passengers' convenience. It is inevitable that new mooring facilities will be installed in a sea area shallower than -4m and dredging will be required to provide a sufficient water depth for mooring/turning basin of the new berth.

Sea bottom configuration at Mokmer requires dredging of sea bed (sand and coral reef) over a $500m^2$ area (its volume is $20{,}000m^3$).

(3) Mooring Facilities

7. Concerning a roll-on/roll-off system, a movable bridge to serve as a

vehicle ramp is installed to ensure smooth loading and unloading of vehicles. (Many requests were found in the interview survey conducted in Bajoe-Kolaka route for the improvement of vehicle ramp, for example "the improvement of ferry-boat to smooth embarking/disembarking heavy equipment through the ramp for irrigation project in Southeast Sulawesi".)

8. According to the Master Plan, on Ferry Route-3 connecting five islands, Flores, Adonara, Lomblen, Pantar and Alor, 500GRT ferry boats are planned to be introduced, although 300GRT ferry boats are operated in the short term plan connecting the three islands, Flores, Adonara and Lomblen.
In this case, mooring facilities should be designed for 500GRT ferry boat (the mooring/breasting dolphins designed for 300GRT ferry boat cannot be used for mooring of 500GRT ferry boat; it means that new mooring/breasting dolphins should be constructed when 500GRT ferry boat is introduced) although on-land facilities are planned to meet the capacities of boarding passengers and loading vehicles of 300GRT ferry boat.

5-2 Ferry Terminal Facilities to be Installed for Short-term Plan

(1) Passenger Terminal Building

9. The passenger terminal building will consist of passenger waiting rooms for departure, an administration office and others (canteens, public toilets, a ticketing booth, a praying room etc.). The required area of a terminal building will be calculated by Table 6-5-2 of Part 2 for each objective ferry-boat. A praying room should be planned to be at appropriate location adjacent to the waiting room.

(2) Parking Lots

10. Parking lots should generally have a sufficient area both for vehicles ready for rolling on (loading parking lot) and for vehicles waiting for arriving passengers (waiting parking lot). However, if the time interval between arrival and departure of ferry-boat at a terminal is long and the loading parking lot and waiting parking lot are not used simultaneously, it is sufficient to install only the larger of the two parking lots and to utilize it for another purpose

depending on the time of day.

The required areas for loading parking lot and waiting parking lot will be calculated by Tables 6-5-3 and 6-5-4 of Part 2.

(3) Mooring Facilities and Vehicle Ramp

11. In the four study routes, a dolphin type will be applied for mooring facilities, consisting of breasting dolphins and mooring dolphins. Movable bridge type vehicle ramp is provided for the smooth loading/unloading of vehicles to ferry-boat, the design of which should be based on the size of ferry-boat to be introduced in Master Plan of each route.

(4) Passenger Access

12. Generally, access way to connect on-land terminal facilities and offshore mooring facilities is of rock causeway or reinforced concrete trestle; one or both of them are applied depending on the sea bed condition. From the point of view of safety, access for passengers between berth and ferry-boat should be separated from vehicular access by using a direct approach to the passenger deck of ferry-boat or at least by the use of fenced-off lanes on the bridge under well controlled boarding/unboarding of passengers.

(5) Electricity, Water and Fuel

13. In all ferry terminals of the four Feasibility Study routes, electricity including lighting for port area will be provided by generators installed in ferry terminals. Ground water will be supplied to passenger terminals and ferry boats. Fuel will be supplied by the fuel trucks of PERTAMINA.

(6) Other Facilities

14. The charging system on ferry service consists of two items, one is the fare according to the size of vehicle, another, the fare according to the volume of cargo. To charge the latter fare, it is necessary to install a truck scale. In most ferry terminals in Indonesia, however, a truck scale has not always been installed except at some larger ferry terminals. It seems adequate to determine the installation of a truck scale by the number of trucks loaded on ferry-boat,

from the points of view of economy and smooth operation. At least in the short-term plan, it seems enough to install truck scales only in Bajoe-Kolaka Route and Palembang-Muntok Route (Among the existing study routes, truck scale is installed only at Bajoe terminal.).

5-3 Layout of Each Ferry Terminal

5-3-1 Mokmer (Biak) -Saubeba (Yapen) Route

(1) Mokmer Terminal

1) Topographic Conditions etc.

15. Mokmer is located about 7km to the east of Biak Sea-port. It is open to the south, unprotected from waves unlike Biak Sea-port which is protected by a coral reef and has no need for a breakwater. Mokmer terminal site was reclaimed in 1944 by United States Army and is flat with six fish breeding ponds in it.

16. Boring data obtained during the Feasibility Study show that at the point of the land-height of +3m, coral is found 1.5m below the land surface covered with sand, and at the point of the water depth of -3m, coral is found 4m below the sea bed.

2) Necessity of a Breakwater and a Groin

17. Waves in Yapen Strait tend to become higher from September to December, and their direction is mainly westerly(SSW-W-NNW). As stated in Section 2-6 of Part 2, the max. height of waves is assumed to be 3.0m. In Ibdi private port located about 7km to the east of Mokmer, a breakwater of about 100m long has been constructed to protect the harbor from westerly waves. Therefore, a breakwater should be constructed also at Mokmer terminal to protect the basin from westerly waves. The layout plan of the breakwater is shown in Fig. 5-3-1.

18. Gravity type breakwater (its length is about 100m) is applied to protect sea bottom materials outside the breakwater coming into the inner part of the

breakwater; for the same purpose, an groin (its length is about 70m) should be installed in the east part of the coast as shown in Fig. 5-3-1. (It is possible for a ferry boat to take refuge in the inner area of the groin when very high easterly waves are generated.)

3) Layout of Mooring Facilities and Basin

19. Dolphin type mooring facilities are installed in the area shown in Fig. 5-3-1 and are well protected from westerly waves by the breakwater. To accommodate a 300GRT ferry boat, the basin surrounded by the breakwater and the groin should be deeper than 2.7m (See Table 6-4-1 Water Depth of Berth, Part 2). After the construction of the breakwater and groin, the inner area will be dredged to have a sufficient water depth to accommodate a 300GRT ferry boat (the area to be dredged is about 5000m^2).

20. Considering that the sea bed of the basin after dredging will be coral rock, water depth of the basin is planned to be 3m below LWS. The width of the mouth of the port (the distance between the tips of the breakwater and the groin) will be approximately 2L (L:length overall of the ferry boat) for safe maneuvering of a ferry boat when it leaves from the berth.

4) Layout of On-Land Facilities (Terminal Building and Parking Lots)

21. According to the demand forecast, one round trip a day by a 300GRT ferry boat between Mokmer and Saubeba is enough to meet the demand for Short-Term Plan. In this case, there will be two alternatives A and B for ferry operation plan:

A: Departure from Mokmer in the morning and arrival at Saubeba
Departure from Saubeba and arrival at Mokmer in the evening
(Night stay at Mokmer)

B: Departure from Saubeba in the morning and arrival at Mokmer
Departure from Mokmer and arrival at Saubeba in the evening
(Night stay at Saubeba)

In the case of alternative A, loading parking lot (650m^2) is used during departure time and a waiting parking lot (950m^2) is used during arrival; as the two types of parking area are not used at the same time in Mokmer terminal, land of 950m^2 is sufficient for the parking area which is used for two purposes mentioned above. (See Table 6-5-3 and 6-5-4 of Part 2)

In the case of alternative B, at the arrival of the ferry boat at Mokmer, parking area will be occupied by both loading vehicles destined for Saubeba and buses/taxis waiting for arriving passengers, which means that land of 1600m^2 should be prepared for the parking area. To determine which alternative should be applied, a more accurate forecast of the daily cargoes/passengers movement between the two islands is required. Therefore a parking area of 1600m^2 is prepared in Mokmer terminal to meet either of the two alternatives mentioned above.

22. A road passes along the back of the terminal site and a public transportation service by mini-bus is available for ferry passengers to go to the center of Biak city. (If many ferry passengers very often use this public transportation, the number of vehicles waiting for ferry passengers in the ferry terminal will decrease, which will lead to a reduction in the waiting parking area required.)

23. For a terminal building in Mokmer, 800m^2 is required (See Table 6-5-2 of Part 2). Total area required for on-land facilities is at least (1600+800)m^{2}x2 =4800m^2 (near 5000m^2) including inner roads etc and two fish breeding ponds should be reclaimed. Fig. 5-3-1 shows the layout plan of on-land facilities at Mokmer terminal.

24. A parking lot for vehicles loading on a ferryboat is planned to be at the east side of the terminal to ensure a smooth flow of vehicles entering the parking lot and leaving for the berth. A one-lane road at the west side of the terminal is used almost exclusively by vehicles disembarking from ferry boat and leaving for destinations (Biak city etc.).

(2) Saubeba Terminal

1) Topographic Conditions etc.

25. Saubeba is located in the northern part of Yapen Island, 16km to the west of Yobi, the nearest settlement. As shown in Fig. 5-3-2, coral reefs exist on the east and the west sides of the site on the coast where a ferry terminal will

be constructed. Because of the good protection against waves, the inlet of terminal site has been utilized for the refuge of small vessels sailing between Yapen and Serui etc. in rough sea conditions.

26. A small river flows into the sea farther to the west side of the site. The topographic condition shows that sand/soil transported by the river will not affect the coast around the site. The coast on the west part of the site is wider than the east part, therefore the west part is selected as the site for constructing on-land terminal facilities.

27. The 34km road connecting Serui, the largest city in Yapen Island, with Saubeba on the north end is now under construction and will be completed in 1993/94. The road will be extended in future to Yobi along the coast and the area for the road should be reserved.

2) Necessity of Breakwaters

28. The Saubeba coast is protected from waves by the coral reefs, but the safe mooring of a ferry boat requires maximum protection from waves, especially from westerly waves. Considering the land and sea bottom configurations, two jetties are planned as shown in Fig. 5-3-2.

3) Layout of Mooring Facilities and Basin

29. Based on such factors as the safe maneuvering of a ferryboat, the lower construction cost of dolphins and the effective protection of mooring area from the westerly and easterly waves, the layout of the mooring facilities is planned as shown in Fig. 5-3-2.

4) Layout of On-land Facilities(Terminal Building and Parking Lots)

30. For the on-land facilities, land area of $5000m^2$ is prepared just the same as in Mokmer terminal. Considering i) the accessibility to Serui and Yobi and also to the mooring facilities, ii) land area required for the future development of the ferry terminal, the location of on-land facilities is planned as shown in Fig. 5-3-2. The layout of on-land facilities including roads is almost the same as that of Mokmer.

5-3-2 Larantuka(Flores)-Terong(Adnara)-Lewoleba(Lomblen) Route

(1) Terong Terminal

1) Topographic Conditions etc.

31. Terong terminal site is located 2.5km to the west of the center of Waiwerang and is protected from the southerly waves coming from Savu Sea by Solor Island. (Waiwerang old sea port is slightly affected by incident waves.) The area between the road and the coast at the terminal site is narrow (about 30m). The point of the water depth of -3m is found 35m off the coastal line (HWL). The new Terong (Waiwerang) sea port is adjacent to the ferry terminal site.

2) Layout of Mooring Facilities

32. As the sea area around the terminal site is calm, breakwaters are not necessary. (The neighboring sea port does not have a breakwater.) Considering that the contour line of water depth is parallel to the coastal line, the arrangement of mooring/breasting dolphins is planned to be parallel to the coastal line to minimize the construction cost of the dolphins.

33. Although this route connects only the three terminals Larantuka (Flores), Terong (Adonara) and Lewoleba (Lomblen) in the Short-Term Plan, the route is planned to be extended as far as Baranusa (Pantar) and Kalabahi (Alor) in the Master Plan where 500GRT ferry boat will be introduced because of severe sea conditions on the route. Therefore, mooring facilities should be designed to be able to accommodate a 500GRT ferry boat which will be introduced in future. The layout plan of the mooring facilities in Terong is shown in Fig. 5-3-3. The ferry boat can approach the berth from the west so as not to disturb the activities of the neighboring sea port.

3) Layout of On-land Facilities(Terminal Building and Parking Lot)

34. In Short-Term Plan, 300GRT ferry boat is introduced on this route and the land area required for on-land facilities is $5000m^2$. There are two alternatives for the layout plan of on-land terminal facilities as follows:

i) to plan terminal facilities in two zones, one is between the road and the coast (Zone A), the other behind the road (Zone B); A terminal building and a loading parking lot are installed in zone A and a waiting parking lot in Zone B; this requires no reclamation,

ii) to plan all on-land facilities to the seaside of the road, which requires the reclamation of sea to have a terminal area of 5000m^2.

The alternative ii) is adopted considering the convenience of passengers although the construction cost increases slightly.

35. Layout of on-land terminal facilities of Terong is shown in Fig. 5-3-3. A loading parking lot is planned to be at east part of the terminal with the same reason as at Mokmer terminal.

(2) Lewoleba Terminal

1) Topographic Conditions etc.

36. Lewoleba terminal site is located 1km to the west of the center of Lewoleba. A sea port exists 300m to the east of the terminal site. The unpaved road runs along the coast leading to the center of Lewoleba. The land for terminal facilities is very flat and is very convenient for the construction of a terminal. The slope of the sea bottom is steep and the contour line of the water depth of -8m is found 40m off the coastal line (HWL). Lewoleba is opened to the north, but is protected from the northerly waves generated in Flores Sea by the northeast peninsula of Lomblen Island and the sea area in front of Lewoleba coast is very calm.

2) Layout of Mooring Facilities

37. As the sea area of the terminal site is calm, breakwaters are not necessary. (The neighboring sea port does not have a breakwater.) Considering that the contour line of water depth is parallel to the coastal line, the arrangement of mooring/breasting dolphins is planned to be parallel to the coastal line to minimize the construction cost of the dolphins. Mooring facilities should be designed to be able to accommodate 500GRT ferry boat which will be introduced in future for the same reason as Terong Terminal. The ferryboat approaches the berth from the west so as not to disturb the activities of the neighboring sea port. The layout plan of the mooring facilities of Terong is shown in Fig. 5-3-4.

3) Layout of On-land Facilities(Terminal Building and Parking Lots)

38. In the Short-Term Plan, 300GRT ferry boat is introduced on this route and the land area required for on-land facilities is 5000m^2. The area between the coast and the existing road is narrow. It is desirable to construct all on-land facilities together and a reclamation is planned to have sufficient area for the installation of all of them where terminal area is 100mx50m and water depth in front of the revetments for reclamation is about 1m above LWS.

39. The layout plan of on-land facilities of Lewoleba is shown in Fig. 5-3-4. Considering the three-forked road located to the west of the terminal, the entrance to the terminal is planned at the east, 60m apart from the three-forked road to relieve traffic congestion on the public road caused by vehicles leaving from or arriving at the terminal. A loading parking lot is planned to be at the east part of the terminal to connect directly with the entrance of the terminal although the installation at the west part is favorable to ensure a smooth flow of vehicles entering the parking lot and leaving for the berth.

5-3-3 Bajoe-Kolaka Route

(1) Bajoe Terminal

1) Topographic Conditions etc.

40. The slope of the sea bottom in the planned terminal site is fairly gentle. Then the existing mooring facilities were constructed 2.7km off the coast and the access road on the jetty connects the berth with the on-land facilities (passenger terminal and parking lot). As the terminal building is located at a considerable distance from the berth causing inconvenience for passengers, it is requested to construct a new terminal building near the berth. There is a shoal wide enough to construct a terminal building and a parking lot near the existing berth. A topographic survey has been conducted around the shoal. Sedimentation at the rate of about 4 to 6cm/year continues in wide area around the berth and a dredging of sea bed around the berth has been requested.

2) Layout of Mooring Facilities and Basin

41. The existing ramp for loading/unloading of vehicles to/from the ferry boat here is fixed type, thus an improvement in the ramp to movable type has been

requested by drivers for smooth loading and unloading of vehicles, especially of large ones. Therefore new mooring facilities with a movable type vehicle ramp are planned as shown in Fig. 5-3-5. Although the location of the mooring facilities was determined to provide the largest water depth possible, the water-depth is still insufficient to accommodate the objective 1000GRT ferry boat. Sedimentation at the planned site will continue though the thickness of sedimentation per year is small. Dredging around the existing berth is urgent and it will be conducted in a few years. The dredging should be conducted along a wide area including the site for the new berth ($66000m^2$)

42. The existing berth will continue to be used for ferry operation even during the construction work of the new berth. After completion, the existing berth can be used as the resting/waiting berth for ferry boat. The interval between the existing berth and the new berth should be wide enough for a ferry boat to approach the existing berth safely (here the interval is planned to be more than 1.0L, (L:length overall of the objective ferry boat). The layout plan of mooring facilities of Bajoe is shown in Fig. 5-3-5. In this terminal, maintenance dredging will be inevitable, for example every ten years or every twenty years, though the period of the dredging is determined by the thickness of sedimentation per year and the thickness to be dredged at a time. At present, fishing boats and cargo ships now utilize the west side tip of the existing jetty for loading/unloading cargoes and some adjustments seem necessary to allow these ships to continue the present activities in the period of the construction work.

3) Layout of On-land Facilities (Terminal Building and Parking Lot)

43. The area required for the on-land facilities is about $16,000m^2$ (Refer to Table 6-5-2, 6-5-3 and 6-5-4 of Part 2):

Terminal Building	$2500m^2$
Loading Parking Lot	$2600m^2$
Waiting Parking Lot	$3000m^2$
	$8100m^2 x2=16200m^2$
	(nearly $16000m^2$)

(If the terminal building is planned to be two stories, the required area will be about $14,000m^2$.)

44. The area of the existing ferry terminal is 100mx150m=15,000m^2 excluding the residence area for the staffs of MOC. This is nearly equal to the area for on-land facilities required in 1989. However, to improve the accessibility of passengers/vehicles to the berth, all on-land facilities are planned to be installed on the shoal mentioned earlier and required area for them will be nearly 16000m^2 (14000m2 in the case of a two-story building of a passenger terminal).

45. The layout plan of on-land terminal facilities of Bajoe is shown in Fig. 5-3-5. A warehouse has been constructed on the reclaimed land of the shoal mentioned above. All of the on-land terminal facilities should be constructed on the reclaimed area of the same shoal. Also, to minimize the construction cost of the terminal facilities, it is advisable to construct separately the passenger terminal/waiting parking lot and loading parking lot as shown in Fig. 5-3-5. Waiting parking lot should be designed not only for mini-bus/general car but also for general bus, considering the present transportation mode at Bajoe ferry terminal. The distance between the new terminal building and the new berth will be as short as 200m compared with 2.7km of the existing one.

(2) Kolaka Terminal

1) Topographic Conditions etc.

46. The existing ferry terminal is very narrow and does not contain a exclusive parking lot. DGLT have a plan to construct a new terminal by reclaiming the sea area in the north of the jetty for an access road to the berth. The neighboring sea area to the north of the planned site will be reclaimed by the local government for other use. A small river flows into the sea on the southeast sea of the jetty. A shoal of coral reef is found about 150m to the northwest of the tip of the berth.

2) Layout of Mooring Facilities

47. The improvement in the roll-on/roll-off system to a movable type is required just the same as in Bajoe terminal. There are two alternatives in the location of mooring facilities to be installed, one is in the southwest of the existing berth (Alternative A) and the other in the northeast (Alternative B). Although a shoal of coral reef exists about 150m to the northwest of the tip of

the berth, it is possible to install a new berth near the shoal (Alternative B) and to keep the distance of 1.0L between the existing berth and the new one for the same reason as in the case of Bajoe terminal. In the case of Alternative A, although it is easy to install a new berth keeping the space of more than 1.0L between the existing berth and the new one, it receives the influence of the neighboring river and will suffer from sedimentation and water depth around the new berth will become shallow in a short time. Therefore, Alternative B is adopted.

The layout plan of mooring facilities is shown in Fig. 5-3-6.

3) Layout of On-land Facilities (Terminal Building and Parking Lot)

48. As mentioned above, the new terminal is constructed on the newly reclaimed land with a terminal building, a loading parking lot and a waiting parking lot installed. (The land of the existing terminal can be utilized for residences for staffs of MOC etc.) The layout plan of on-land terminal facilities is shown in Fig. 5-3-6. The area for the terminal is planned to be about $16000m^2$ considering the simultaneous use of the loading and waiting parking lots. Waiting parking lot should be designed not only for minibus/general car but also for general bus which will transport passengers to Kendari etc.

5-3-4 Palembung-Muntok Route

(1) Palembung Terminal

1) Topographic Conditions etc.

49. The existing Palembang terminal is located on the right bank of the 400m wide Musi River (the water depth of 5m below LWS is found 35m off the bank) and is surrounded by a small river, a road and residences. The area of the terminal is approximately $30000m^2$, of which about $9000m^2$ is used for a terminal building, administration office and parking lots; the remaining area is a marsh.

2) Layout of Mooring Facilities

50. The existing mooring facilities are designed for 150GRT with pontoon-type.

In the Short-Term Plan, a 500GRT ferry boat will be introduced, which requires the construction of new large-scale mooring facilities with a movable bridge type vehicle ramp. The layout plan of mooring facilities of Palembang is shown in Fig. 5-3-7. The facilities are installed upstream of the existing berth so as not to disturb the small ferries now operated in this route approaching the existing berth during the construction of the new mooring facilities.

3) Layout of On-land Facilities(Terminal Building and Parking Lot)

51. In the Short-Term Plan, two existing 100-150GRT ferries and a new 500GRT ferry boat are operated. The required area for on-land facilities is determined based on the loading capacity of the 500GRT ferry boat (the numbers of passengers and vehicles) (See Table 6-5-2 to 6-5-4 of Part 2), that is;

Terminal Building	$1400m^2$
Loading Parking Lot	$950m^2$
Waiting Parking Lot	$1500m^2$
	$3850m^2 x2=7700m^2$
	(nearly $8000m^2$)

52. According to the Master Plan, two 500GRT ferries are operated using only the new berth. Therefore, a new terminal building should be located near the new berth. The existing passenger terminal was constructed in 1982 and is too small to accommodate all of the passengers going on board the 500GRT ferry boat. In the present ferry operation, the ferry boat is moored from its arrival in the morning until departure at night and some passengers may wait in the ferry boat, not in the passenger terminal. With the start of one round trip a day by a 500GRT ferry boat, berthing time (except berthing for night stay) is planned to be one hour, thus almost all passengers have to wait in the passenger terminal. Then the passenger terminal should be large enough to accommodate all those passengers boarding the 500GRT ferry boat. The administration office was constructed in 1975 and is too old. Considering the convenience of the administration, a new administration office is planned to be in the new terminal building.

53. A road passes along the back of the terminal as mentioned earlier and a public transportation service by mini-bus is available for ferry passengers to go to the center of Palembung. In reality, a large number of passengers use the

public transportation service and the waiting parking lot has not been used so much. However the increase of ferry passenger transportation demand and the introduction of a large scale ferry boat will require a transportation service exclusively for ferry passengers, thus the waiting parking lot is planned to be constructed.

54. The layout plan of on-land terminal facilities of Palembang is shown in Fig. 5-3-7. A passenger terminal and a waiting parking lot are planned to be constructed on a swamp between the existing administration office and the bank of Musi River. The existing waiting parking lot is wide enough to be converted to a new loading parking lot. The plan makes it possible to utilize all of the existing terminal facilities during the construction of new terminal facilities.

55. The ferry terminal is planned to have two entrance/exit to ensure the smooth flow of vehicles, one of which will be used almost exclusively by vehicles disembarking from ferry boot.

(2) Muntok Terminal

1) Topographic Conditions etc.

56. Muntok ferry terminal site, on the east side of Tanjung Kelian, is located 3.5km to the west-south-west of Muntok sea port. The coast is protected against westerly waves generated in September-March but is affected by south-east waves generated in June-August. The sounding survey conducted in November, 1992 shows that the soil conditions at offshore sea bottom are; N=0 between 0m and 14m below the sea bed, N=17 to 50 between 14m and 16m, N>50 between 16m and 18m.

The pavement of the road connecting the site with the center of Muntok was completed in 1992.

2) Necessity of a breakwater

57. As mentioned above, the site is open to the southeast and is not protected against southeast waves. This implies the need of breakwaters. However, N-value of the 14m-thickness soil layer below the sea bottom is almost zero and it is practically difficult to construct gravity type breakwaters. Considering

that the site does not face directly the open sea and only wind waves of low wave height will arrive at the site, curtain wall type breakwater is planned to be installed (According to the result of wave hindcasting conducted in the Feasibility Study, the maximum significant wave height is 1.0m with its direction of SSE).

3) Layout of Mooring Facilities

58. Considering the wave direction (SE) and the safe approach of a ferry boat to the facilities, the layout plan of mooring facilities and breakwater of Muntok is planned as shown in Fig. 5-3-8. The ferry boat approaches the berth at an angle of 45° to the coastal line.

4) Layout of On-land Facilities(Terminal Building and Parking Lot)

59. For the on-land facilities, land area of $8000m^2$ is prepared just the same as in Palembang terminal. Considering i) the existence of the light house, the residences and the road connecting with Muntok, ii) access to the berth, the location of the site is determined as shown in Fig. 5-3-8. Loading parking lot is planned to be at the east side of the terminal to ensure the smooth flow of vehicles entering into the parking lot and leaving for the berth. Waiting parking lot should be designed not only for general car/mini-bus but also for general bus, considering that general buses are transporting passengers from Muntok sea port to Pangkal Pinang, Sungai Liat etc.

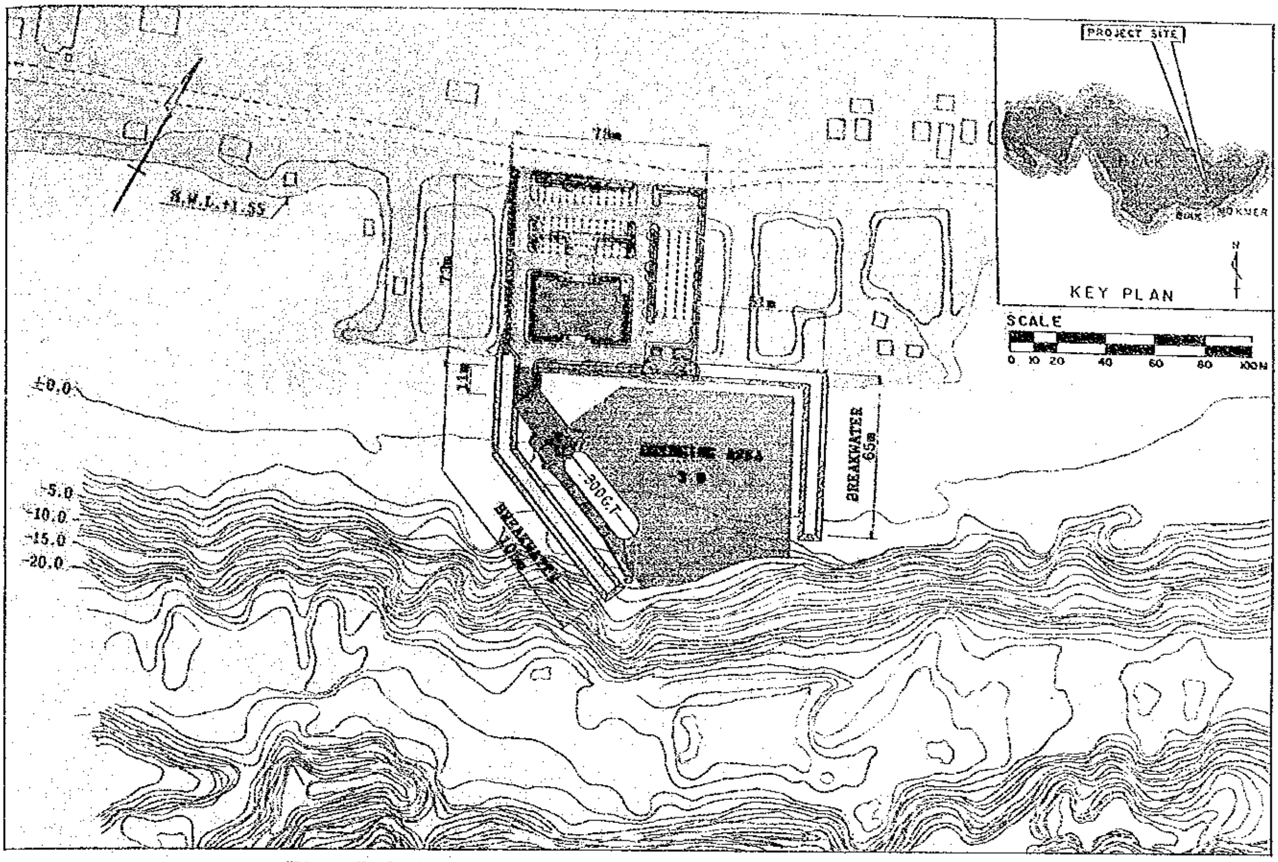


Fig. 5-3-1 Layout of Mokmer Ferry Terminal

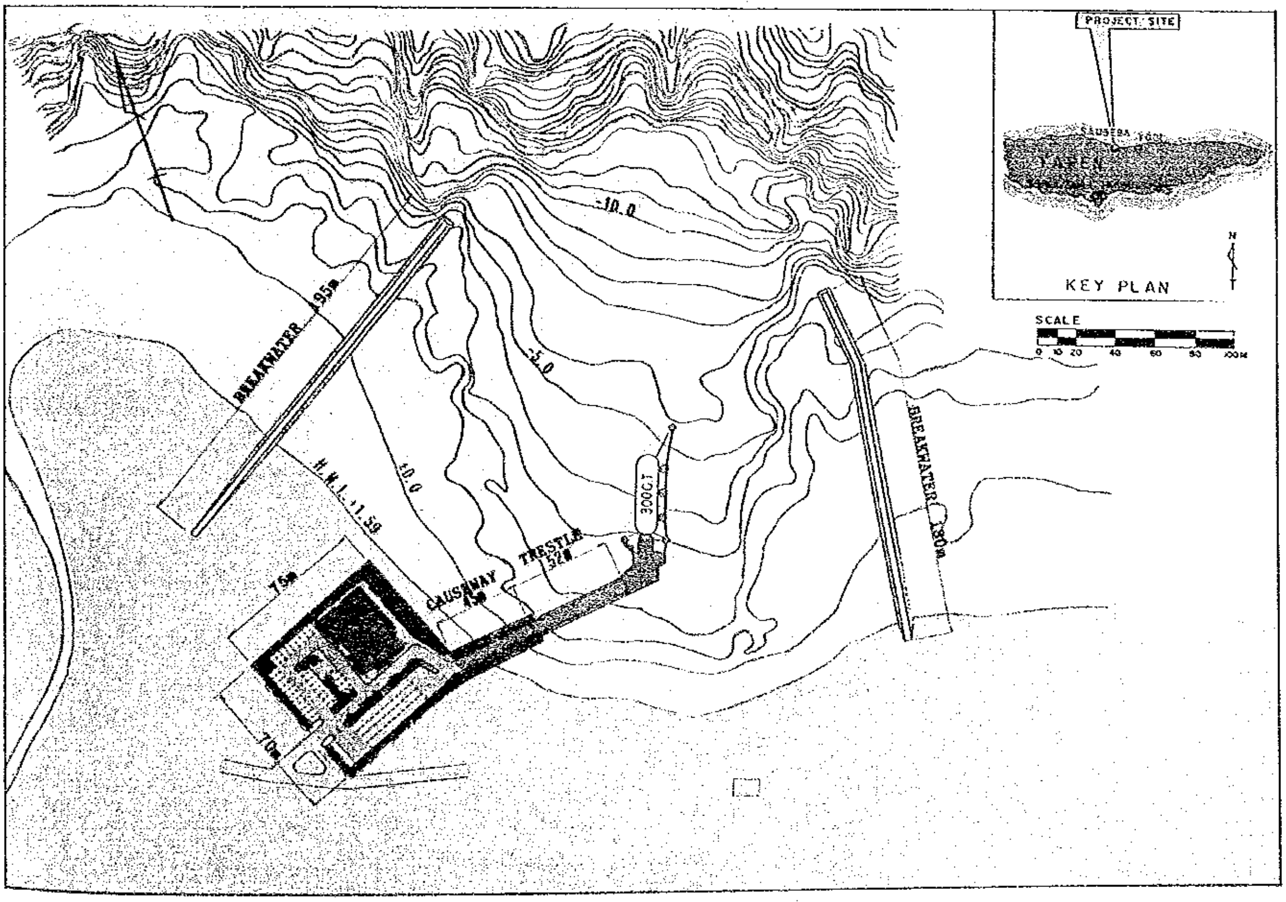


Fig. 5-3-2 Layout of Saubeba Ferry Terminal

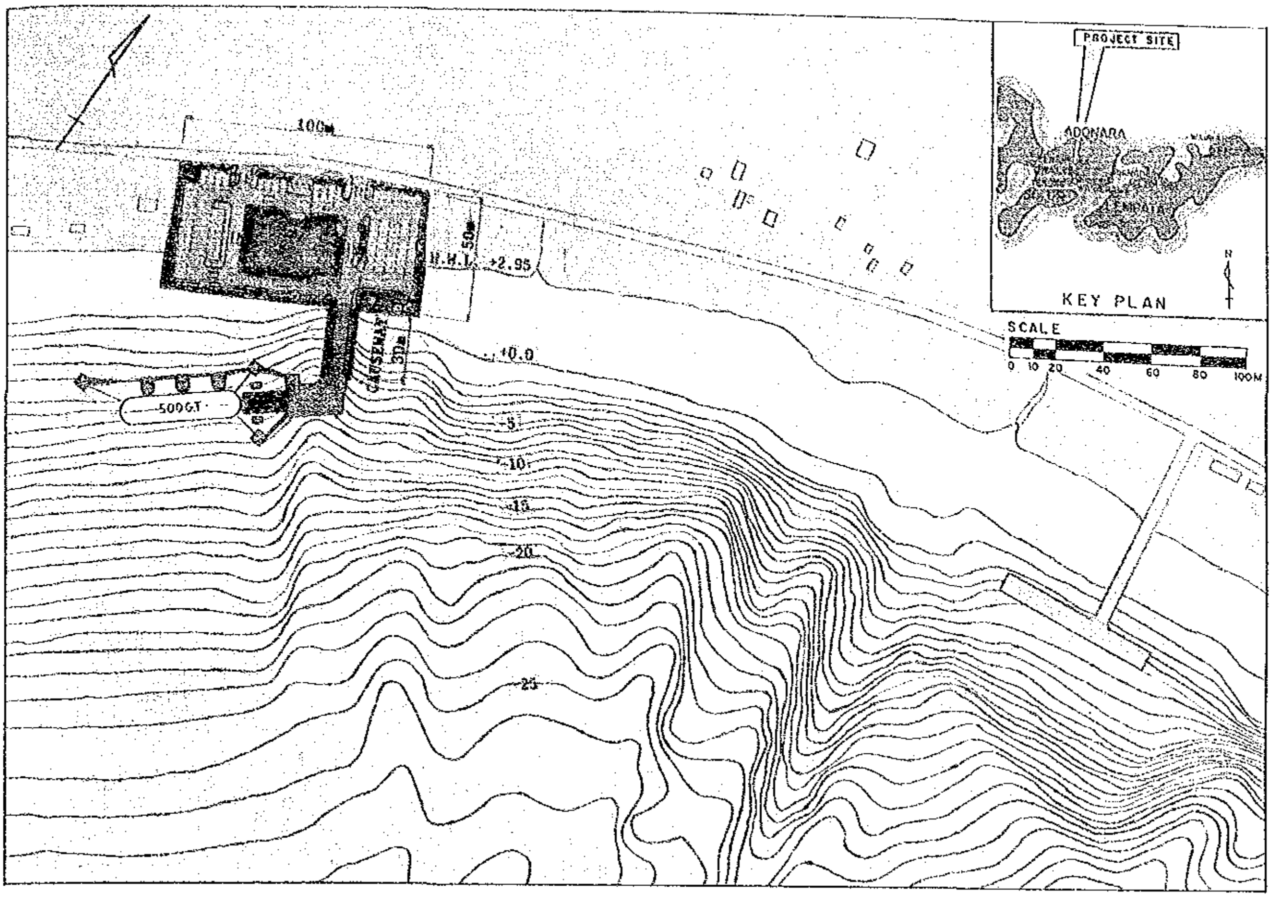


Fig. 5-3-3 Layout of Terong Ferry Terminal

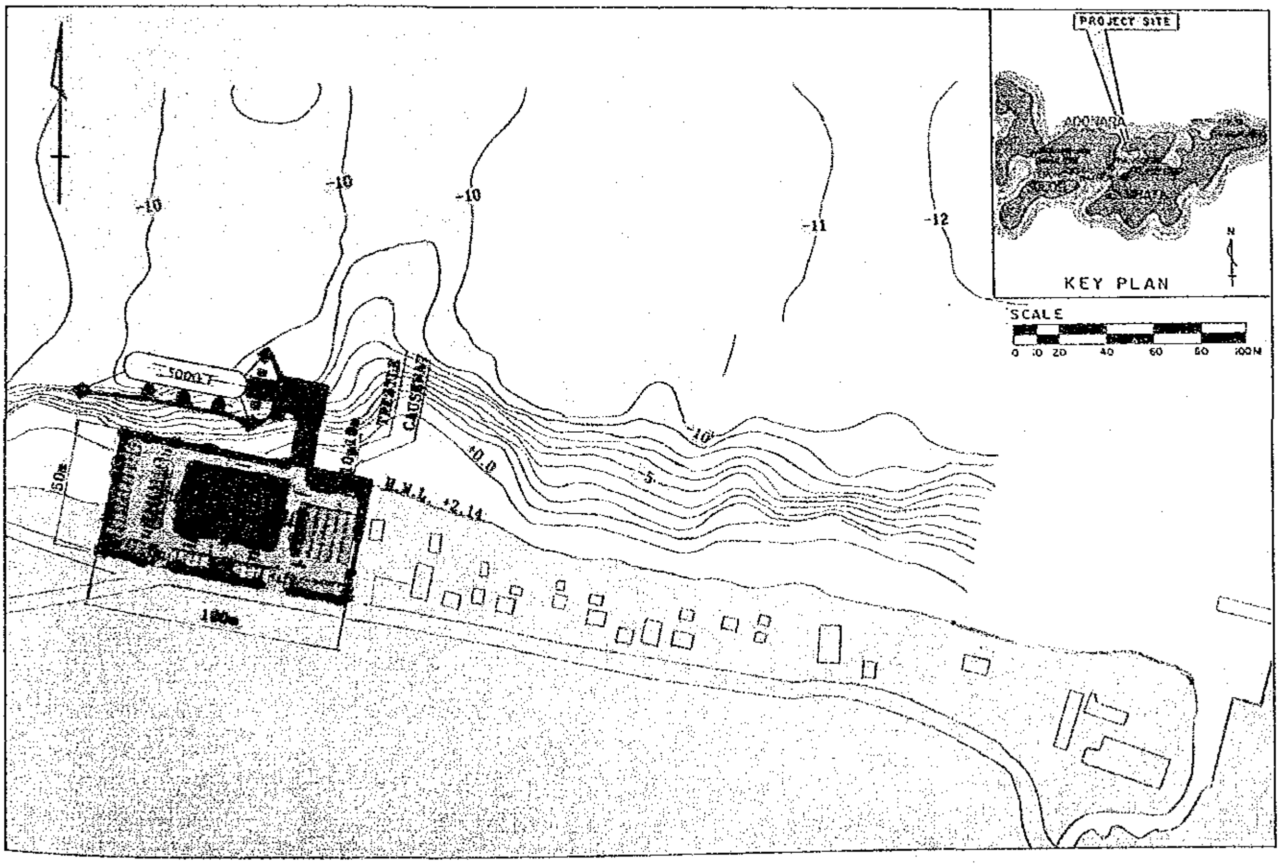


Fig. 5-3-4 Layout of Lewoleba Ferry Terminal

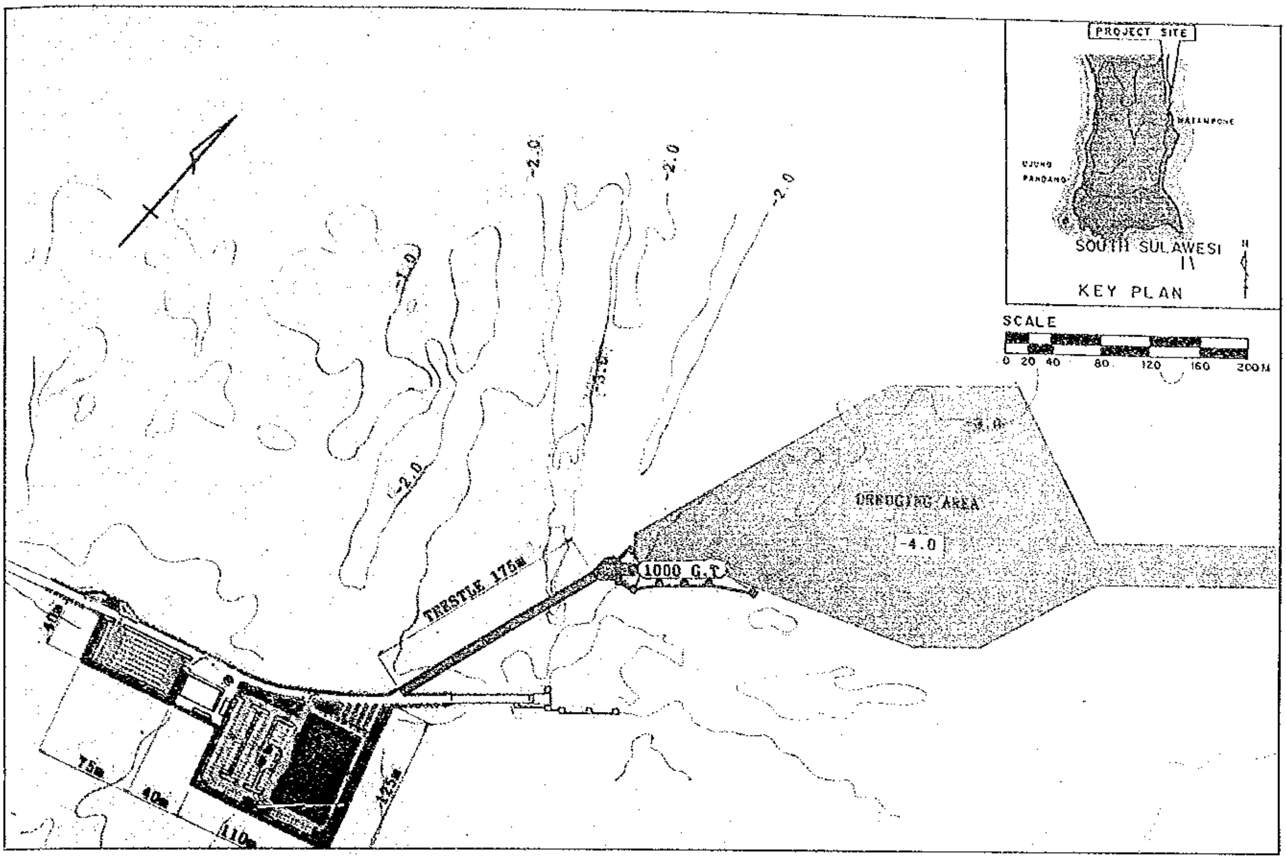


Fig. 5-3-5 Layout of Bajoe Ferry Terminal

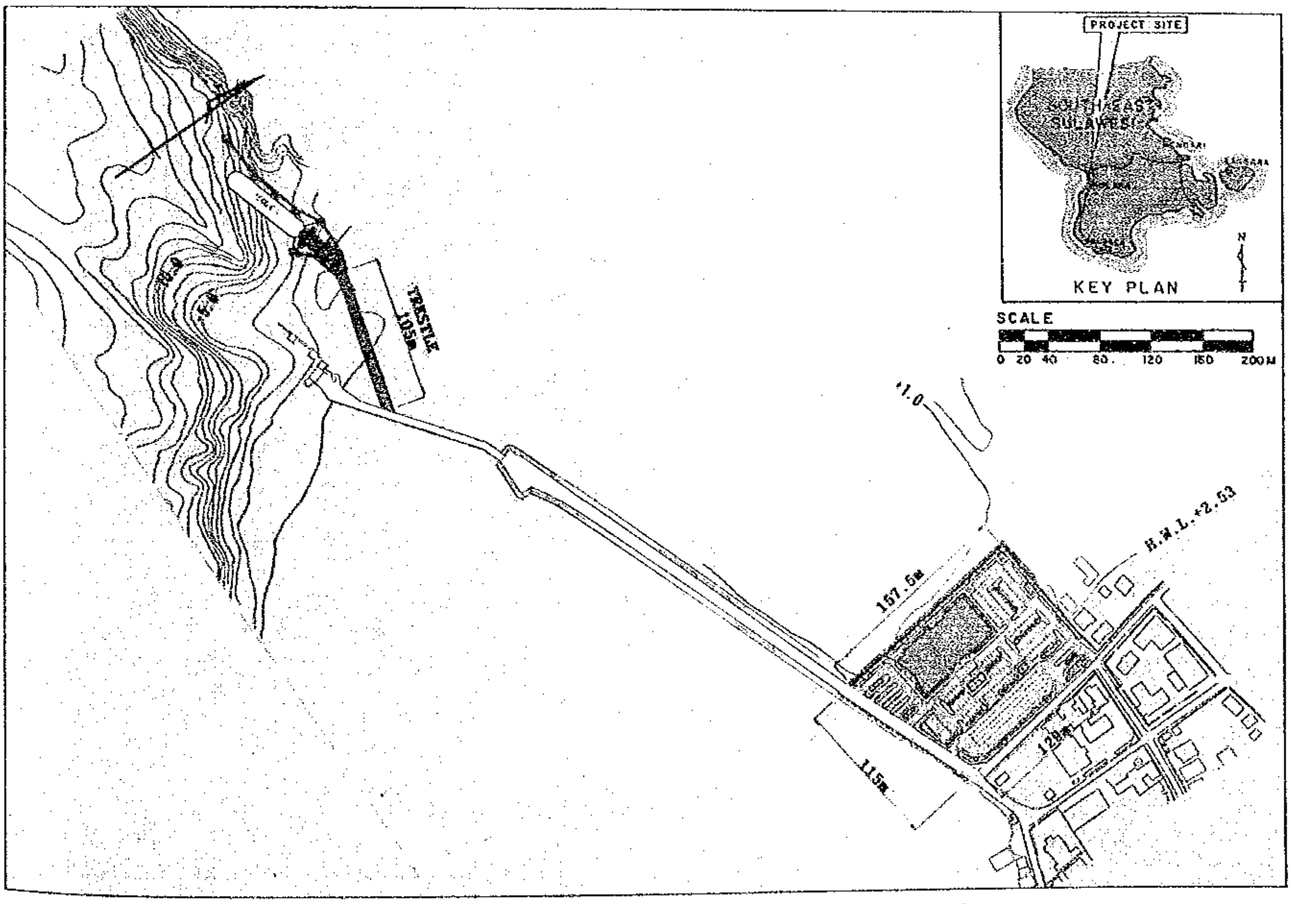


Fig. 5-3-6 Layout of Kolaka Ferry Terminal

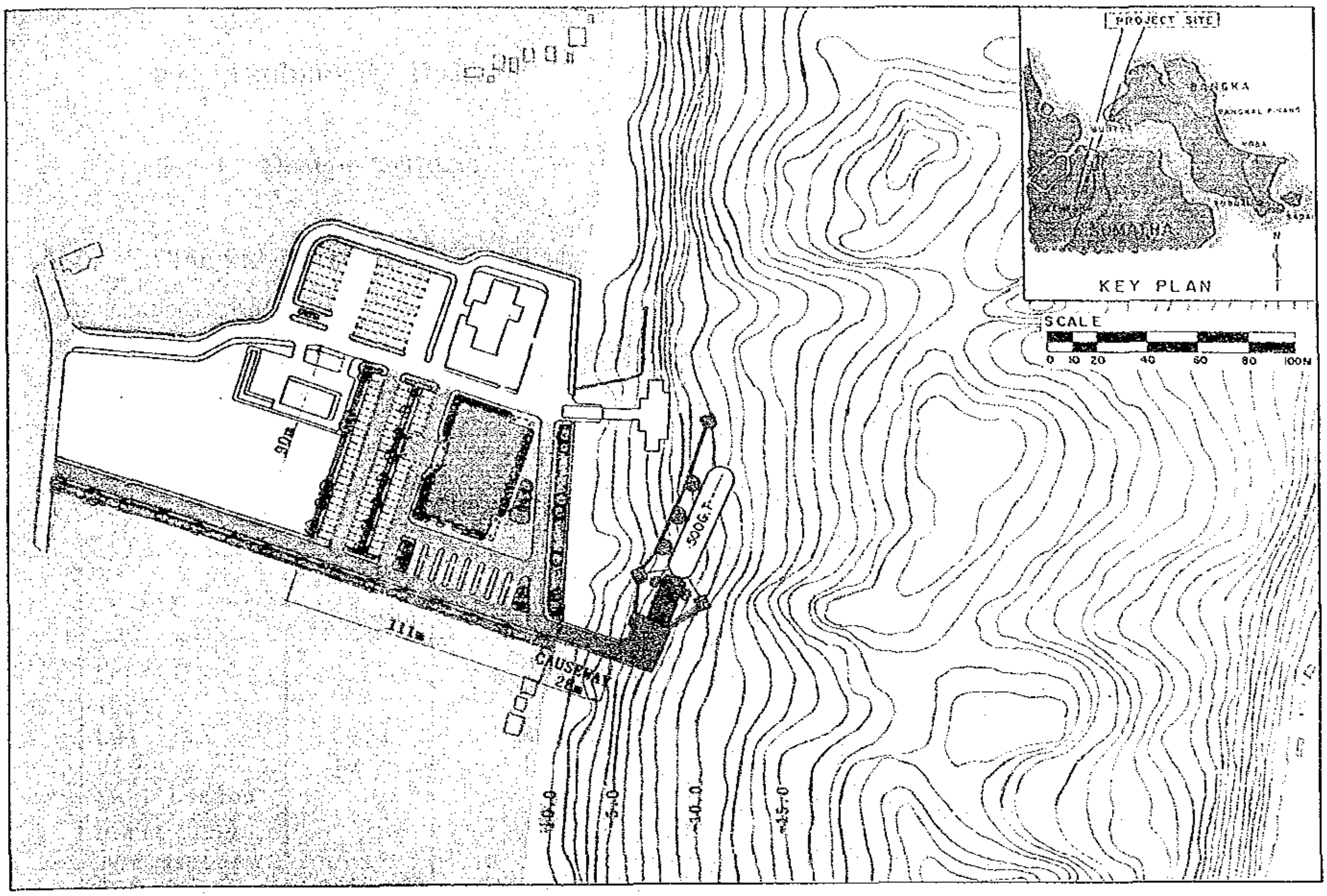


Fig. 5-3-7 Layout of Palembang Ferry Terminal

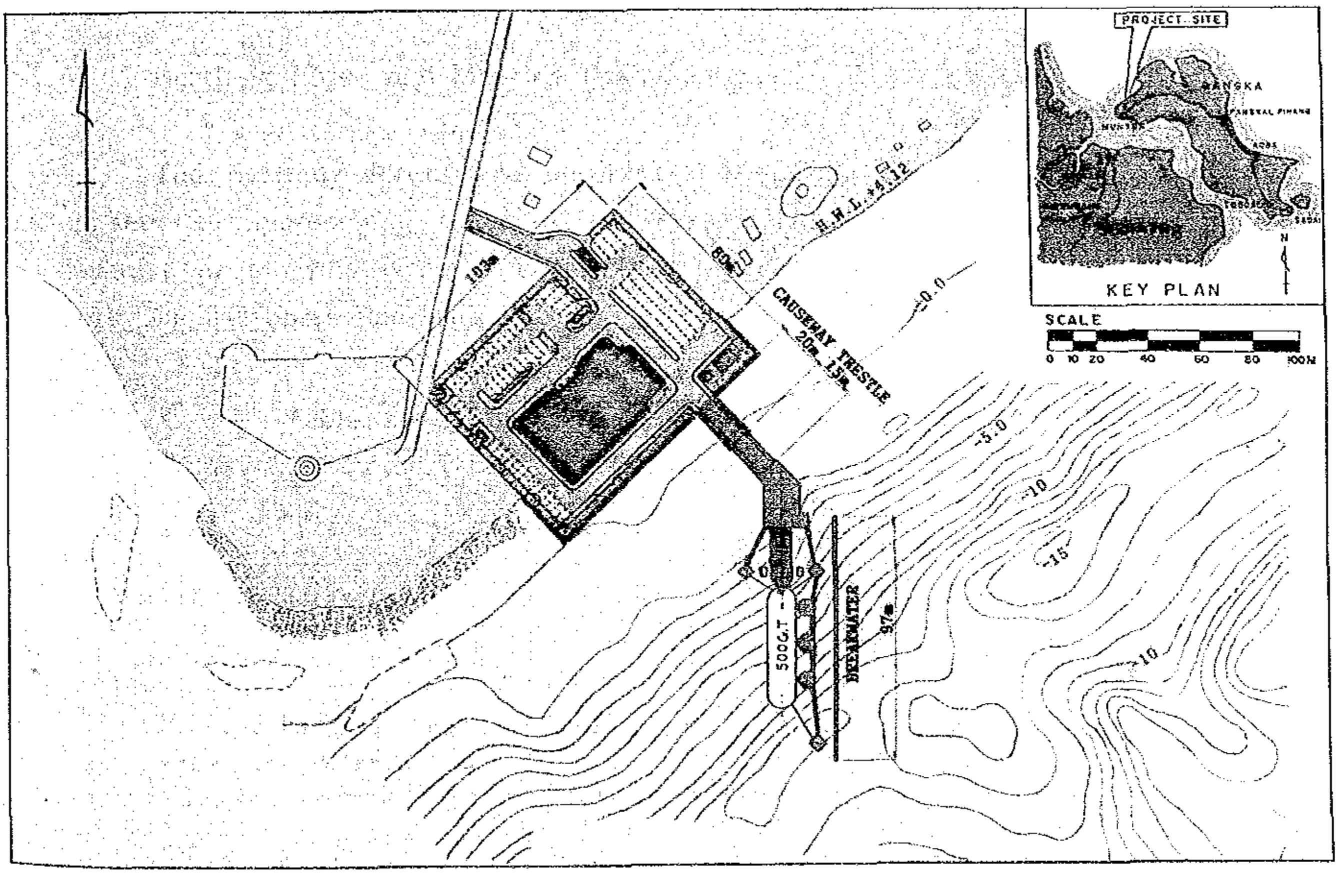


Fig. 5-3-8 Layout of Muntok Ferry Terminal

5-4 Preliminary Design

5-4-1 Design Criteria

60. Planned Ferry Boat

The capacities and dimensions of the planned ferry boats for each terminal are as shown below.

Table 5-4-1 Planned Ferry Boats

Ferry Boat	Mokmer Saubeba	Terong, Lewoleba		Bajoe Kolaka	Palembang Muntok
		Mooring F.	On-land F.		
Capacity (GRT)	300	500	300	1,000	500
LOA (m)	38.5	47.0	-	70.0	47.0
B(m)	10.5	11.5	-	14.0	11.5
Full Loaded Draft (m)	2.2	2.6	-	3.5	2.6
Passenger	300	-	300	600	500
Vehicle	4tx15	-	4tx15	8tx27	4tx20

61. Berthing Force and Mooring Post Capacity

The berthing forces are determined based on a berthing velocity of 30 cm/sec, an approaching angle of 10 degrees and fully loaded condition. The capacity of mooring posts is determined based on the Technical Standards for Ports and Harbours Facilities (Japan).

Table 5-4-2 Berthing Force and Mooring Post Capacity

	Mokmer Saubeba	Terong Lewoleba	Bajoe Kolaka	Palembang Muntok
Berthing Energy (ton·m)	1.52	2.40	5.85	2.40
Tractive Force on Mooring Post of				
Mooring Dolphin (ton)	15	15	25	15
Breasting Dolphin (ton)	15	15	25	15

62. Tide

The significant tide levels at each terminal are as follows:

Table 5-4-3 Tide Levels

	Mokmer	Saubeba	Terong	Lewoleba	Bajoe	Kolaka	Palembang	Muntok
H.H.W.S	1.55	1.59	2.95	2.14	2.32	2.53	4.10	4.12
M.S.L	0.92	0.92	1.51	1.19	1.32	1.46	2.05	1.89
L.L.W.S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

63. Current

Based on the field survey result velocities of the current for the design are as shown below.

Table 5-4-4 Current Velocity

	Mokmer	Saubeba	Terong	Lewoleba	Bajoe	Kolaka	Palembang	Muntok
Velocity (cm/sec)	65	58	26	80	35	28	54	69

64. Wave

At the sites of Terong, Lewoleba, Bajoe, Kolaka and Palembang, the wave conditions are good for ferry operation and no particular measures are necessary for the design of mooring facilities. However, a breakwater should be provided in Mokmer, Saubeba and Muntok terminal sites against the waves as shown in Table 5-4-5.

Table 5-4-5 Design Waves

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

65. Sub-soil

The sub-soil conditions in each terminal site are summarized below. The sub-soil data of Terong Waiwerang shown in this report were obtained from the eastern side of the existing sea port. After the soil investigation had been carried out the terminal site was shifted to the western side of the existing sea port. The soil data of the eastern side were applied without any modification for the design. Therefore, new soil data should be obtained for the detailed design.

1) Mokmer

Land Site			Sea Site		
Elevation (m)	Sub-soil	N-value	Elevation (m)	Sub-soil	N-value
+2.3 ~ -12.0	Sand/coral	30	-5.0 ~ -18.0	Sand/coral	24
-12.0 ~	Sand/coral	50	-18.0 ~	Sand/coral	≥50

2) Saubeba

Land Site			Sea Site		
Elevation (m)	Sub-soil	N-value	Elevation (m)	Sub-soil	N-value
+4.2 ~ -3.5	Sand	20	-3.2 ~ -17.0	Sand/coral	25
-3.5 ~ -9.0	Sand/coral	35	-17.0 ~	Sandy coral	≥50
-9.0 ~	Sandy Gravel	≥50			

3) Terong Waiwerang

Land Site			Sea Site		
Elevation (m)	Sub-soil	N-value	Elevation (m)	Sub-soil	N-value
+5.0 ~ +3.5	Sand	≥100	-0.5 ~ -5.5	Gravelly Sand	30
+3.5 ~ +2.0	Silty Sand	≥95	-5.5 ~	Gravelly Sand	≥50
+2.0 ~	Sandy Gravel	≥77			

4) Lewoleba

Land Site			Sea Site		
Elevation (m)	Sub-soil	N-value	Elevation (m)	Sub-soil	N-value
+2.5 ~ -7.5	Gravelly Sand	13 ~ 47	-0.5 ~ -10.5	Sand	20
-7.5 ~ -12.5	Gravelly Sand	48 ~ 69	-10.5 ~ -13.5	Gravelly Sand	50
-12.5 ~ -20.0	Gravelly Sand	6 ~ 50	-13.5 ~ -23.5	Sandy Gravel	20
-20 ~	Silty Clay	≥80	-23.5 ~	Silty Clay	≥50

5) Bajoe

Land Site			Sea Site		
Elevation (m)	Sub-soil	N-value	Elevation (m)	Sub-soil	N-value
0.0 ~ -2.5	Sand/coral	2	-3.0 ~ -8.0	Silty Clay	9
-2.5 ~ -9.0	Limestone	≥50	-8.0 ~ -26.0	Limestone	20
-9.0 ~	Limestone	20	-26.0 ~	Limestone	40

6) Kolaka

Land Site			Sea Site		
Elevation (m)	Sub-soil	N-value	Elevation (m)	Sub-soil	N-value
+1.0 ~ -27.0	Silty Sand	8	-5.0 ~ -8.0	Sand	2
-27.0 ~	Sandy Silt	10	-8.0 ~ -31.0	Silty Sand	7
			-31.0 ~	Sandy Silt	12

7) Palembang

Land Site			Sea Site		
Elevation (m)	Sub-soil	N-value	Elevation (m)	Sub-soil	N-value
+1.8 ~ -7.0	Silty Clay	0	-2.5 ~ -8.5	Silty Clay	0
-7.0 ~ -18.0	Clayey Sand	10	-8.5 ~ -18.0	Clayey Sand	5
-18.0 ~ -26.0	Sand	40	-18.0 ~ -24.0	Sand	40
-26.0 ~	Clay	≥50	-24.0 ~	Clay	≥50

8) Muntok

Land Site			Sea Site		
Elevation (m)	Sub-soil	N-value	Elevation (m)	Sub-soil	N-value
+4.5 ~ -4.5	Sand	45	-1.0 ~ -3.0	Sandy Clay	6
-4.5 ~	Sand	≥50	-3.0 ~ -15.0	Clay	0
			-15.0 ~	Sand	50

The soil profiles of the above boring logs are presented in Fig. 2-7-1A to Fig. 2-7-8A of Part 3 of the Appendix.

7. Load Condition

The following loads are used in the design of the marine structure.

1) Dead Load

Reinforced concrete	:	2.45 t/m3
Plain concrete	:	2.35 t/m3
Steel	:	7.80 t/m3
Sand (in air)	:	1.80 t/m3
(in water)	:	1.00 t/m3

2) Live Load

- Uniform Live Load : 2.0 t/m2 under ordinary condition
  1.0 t/m2 under seismic condition

- Wheel Load : T-20 (Load Capacity 8.0 ton): Bajoe, Kolaka
  T-14 (Load Capacity 5.6 ton): Other Terminals

66. Seismic Coefficient

Indonesia is classified into six areas according to the seismic conditons, as shown in Fig. 5-4-1A of Appendix, Part 3. The design seismic coefficient is determined in accordance with the following formula.

Design seismic coefficient (kh) = Regional Seismic Coefficient
x Coefficient of Importance:

Design Seismic Coefficient (kh)

Mokmer	0.10	Bajoe	0.05
Saubeba	0.10	Kolaka	0.05
Terong	0.10	Palembang	0.05
Lewoleba	0.10	Muntok	0.05

67. Service Life

The service life of the mooring facility is 50 years.

68. Allowable Stress

1) Concrete

Standard design strength	:	$\sigma y=$	225kg/cm2
Allowable bending compressive stress	:	$\sigma ca=$	75kg/cm2

2) Reinforcing Bar

Round Bar

Yield strength	:	$\sigma y=$	2,400 kg/cm2
Allowable tensile stress	:	$\sigma a=$	1,400 kg/cm2

Deformed Bar

Yield strength	:	$\sigma y=$	3,200 kg/cm2
Allowable tensile stress	:	$\sigma a=$	1,855 kg/cm2

3) Structural Steel

Yield strength	:	$\sigma y=$	2,500 kg/cm2
Allowable axial tensile stress	:	$\sigma ta=$	1,400 kg/cm2
Allowable axial compressive stress:			
$l/r \leqq 20$	:	$\sigma ca=$	1,400 kg/cm2

$20 < l/r \leqq 93$	:	$\sigma ca = 1{,}400 - 8.4\ (l.r-20)$
$93 < l/r$	:	$\sigma ca = \dfrac{12000000}{6700 + (l/r)}$

Allowable bending stress	:	$\sigma ba =$ 1,400 kg/cm2
Allowable shearing stress	:	$\sigma sa =$ 800 kg/cm2

4) Steel Sheet Pile

Yield strength	:	$\sigma y =$ 3,000 kg/cm2
Allowable bending stress	:	$\sigma ba =$ 1,800 kg/cm2
Allowable shearing stress	:	$\sigma sa =$ 1,000 kg/cm2

5) Sand Fill

Unit weight in air	:	$\gamma =$ 1.8 t/m3
Unit weight in water	:	$\gamma' =$ 1.0 t/m3
Angle of internal friction	:	$\phi =$ 30

6) Rock Fill

Unit weight	:	$\gamma =$ 1.8 t/m3
Unit weight	:	$\gamma' =$ 1.0 t/m3
Angle of internal friction	:	$\phi =$ 40

7) Corrosion Rate of Steel

In sea water:

Above HWS	:0.30 mm/year. one side
Portion between HWS and sea bottom	:0.10 mm/year. one side
Portion in bed mud layer	:0.03 mm/year. one side

In soil:

Above residual water level	:0.03 mm/year. one side
Below residual water level	:0.02 mm/year. one side

1) Under certain combinations of loads, the following increased allowable stresses of a structure were applied:

Load Combination	Percentage of Increase
Dead load + Live Load + Impact	No increase
Dead Load + Live Load + Impact + Wind	33 %
Dead Load + 1/2 Live Load + Earthquake	50 %

2) Safety factors

i) Circular failure for normal condition : 1.3

ii) Sliding for normal condition : 1.2

Sliding for seismic condition : 1.0

Overturning for normal condition : 1.2

Overturning for seismic condition : 1.1

iii) Steel sheet pile

Embedded length for normal condition : 1.5

Embedded length for seismic condition : 1.2

iv) Steel Pile/Concrete Pile

Bearing capacity for normal condition : 2.5

Bearing capacity for seismic condition : 1.5

Pull out capacity for normal condition : 3.0

Pull out capacity for seismic condition : 2.5

5-4-2 Mooring Facility

1) Mokmer Terminal

70. The detailed layout of the mooring facilities of Mokmer ferry terminal is shown in Fig. 5-4-1.

(1) Breakwater

71. The breakwater is designed to protect the mooring berth against WSW waves of $H1/3 = 3.0m$. The structural type of this breakwater was decided as a rubble mound type considering the wave height, water depth and availability of construction materials. The typical cross section is shown in Fig. 5-4-2 and significant dimensions are as follows.

- Crown height	:	LWS + 3.0 m
- Crown width	:	3.0 m
- Slope gradient	:	Seaward 1:2, Harbor side 1:1.5
- Min. weight of armour stone	:	1.0 ton
- Max. water depth	:	LWS - 5.0 m
- Overall length	:	120 m

(2) Groin

72. Along the east side of the harbor basin a groin is provided to protect the basin from sedimentation due to littoral drift sand. A rubble mound type structure was also adopted for the groin. The significant dimensions are as follows;

- Crown height	:	LWS + 3.0 m
- Crown width	:	3.0 m
- Slope gradient	:	Seaward 1:2, Harbor side 1:1.5
- Min. weight of armour stone	:	1.0 ton
- Max. water depth	:	LWS -5.0 m
- Overall length	:	65 m

(3) Harbor Basin

73. Water depth of the harbor basin is required to be more than 2.7 m below LWS for the planned ferry boat of 300 GRT. In this case, however, it is planned to be 3.0 m below LWS considering that the seabed material is coral rock. The area of the harbor basin was determined as shown in Fig. 5-4-1 based on the maneuverability of the ferry boats. The required dredging volume is estimated to be about 15,000 m^3.

(4) Breasting Dolphins

74. Each breasting dolphin along the ship side shall be able to absorb the ship berthing energy of 1.52 ton*m, therefore, V-type rubber fender of 400 mm in height and 2.5 m in length will be installed. Reaction force of the fender is 37.5 ton which will be withstood by the breasting dolphin. The structural type of the dolphin was determined as steel pile type considering the sub-soil conditions of the terminal site.

75. As explained in Chapter 6 of Part 2, three (3) breasting dolphins are provided along the ship side in order to accommodate not only 300 GRT ferry boats but also smaller ferry boats. The typical cross section of the dolphin is shown in Fig. 5-4-3 and the significant dimensions are as follows;

- *Super structure* : Reinforced concrete 4.0 m x 4.0 m x 1.5 to 3.0 m
- Foundation pile : Steel pipe piles
  400 mm dia. x 12 mm thick x 11.0 m long x 6 pcs.
- Mooring post : 15 ton

76. The breasting dolphin at the bow side is designed to be able to absorb a berthing energy of 1.12 ton*m, and 6 pieces of V-type rubber fenders 400 mm high and 1.0 m long will be installed. Reaction force of the fender of 11.3ton will be withstood by the breasting dolphin. The significant dimensions of the dolphin are as follows;

- Super structure : Reinforced concrete 1.5 m x 1.5 m x 7.0 m
- Foundation pile : Steel pipe piles
  400 mm dia. x 12 mm thick x 10.0 m long x 8 pcs.

(5) Mooring Dolphin

77. Three(3) mooring dolphins are provided for this mooring berth and a mooring post of 15 ton tractive force is installed on each dolphin. The structural type was decided as steel pile type for the same reason as for the breasting dolphins. The typical cross section of the mooring dolphin is shown in Fig. 5-4-4 and the dimensions are as follows;

- Super structure : Reinforced concrete 3.0 m x 3.0 m x 1.0 m
- Foundation pile : Steel pipe piles
  400 mm dia. x 12 mm thick x 11.0 m long x 4 pcs.
- Mooring post : 15 ton

(6) Movable Bridge

78. The length of movable bridge was decided as 8.0 m based on the tidal range of 1.55 m, overlap of 1.0 m between ship ramp and movable bridge and the maximum gradient of 17 %. Width of the movable bridge was determined as 7.0 m as recommended in Chapter 6 of Part 2.

(7) Landing Deck

79. A landing deck 12 m wide and 20 m long is provided behind the movable bridge. This deck is made of concrete beams and slab supported by steel pipe piles of 500 mm dia. Top elevation of the deck has been determined as 2.5 m above LWS considering the tidal range and wave conditions.

80. The typical cross section of movable bridge, breasting dolphin at the bow side and landing deck is illustrated in Fig. 5-4-5.

(8) Access Way

81. The access way to connect the on-land terminal facilities and the landing deck of the mooring facility is a causeway 11 m in length because the water depth is shallow and the subsoil has enough bearing capacity. The width of access way had been decided as 8.0 m consisting of two(2) vehicle lanes amounting to 6.0 m and 1.0 m sidewalks at both sides. The typical cross section of causeway is shown in Fig. 5-4-6.

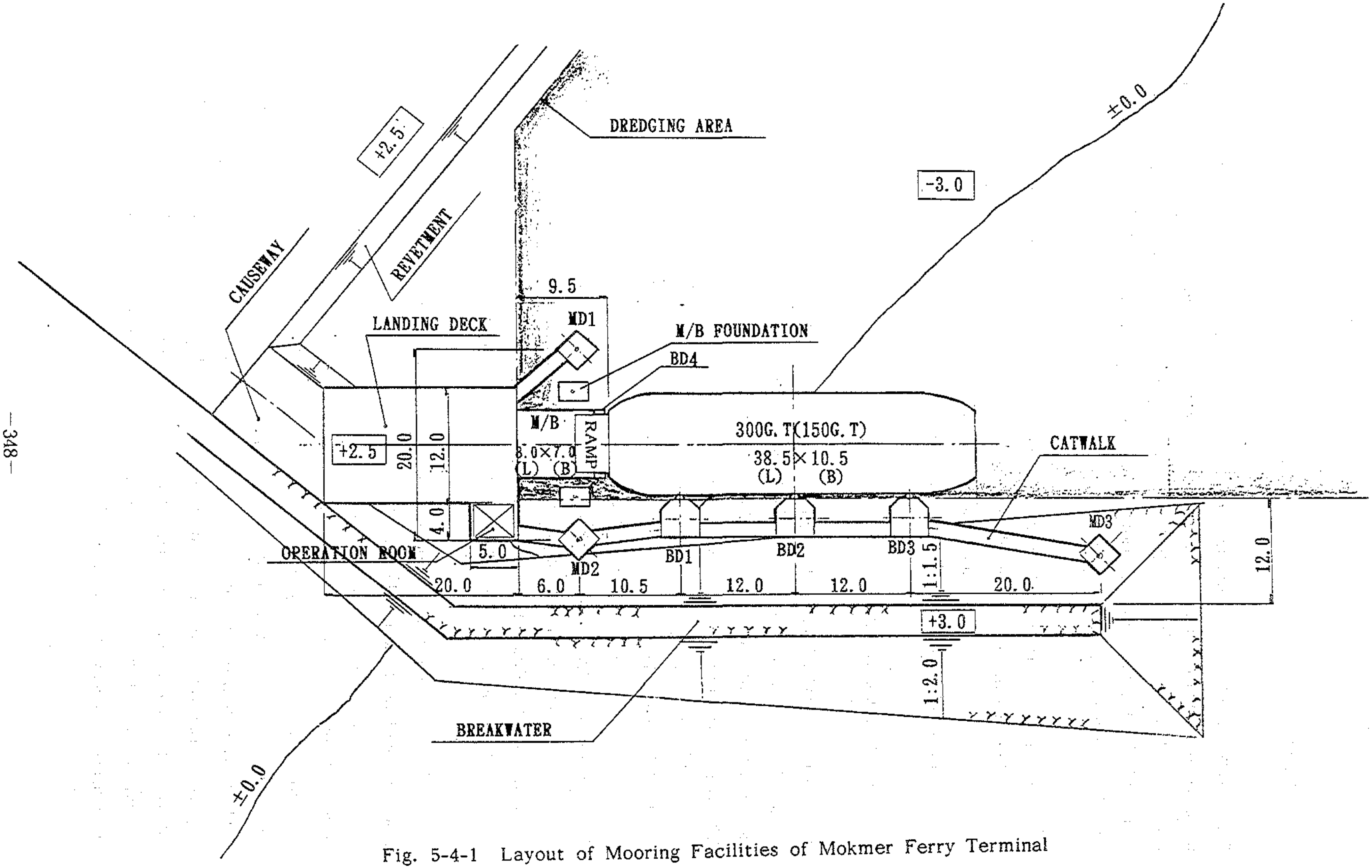
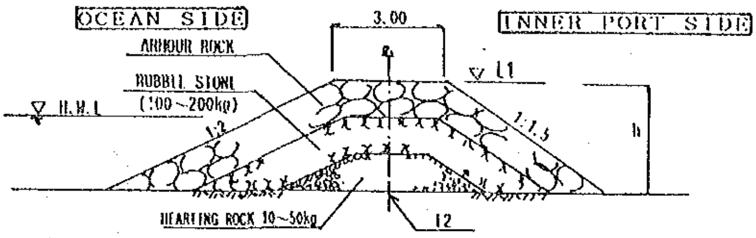


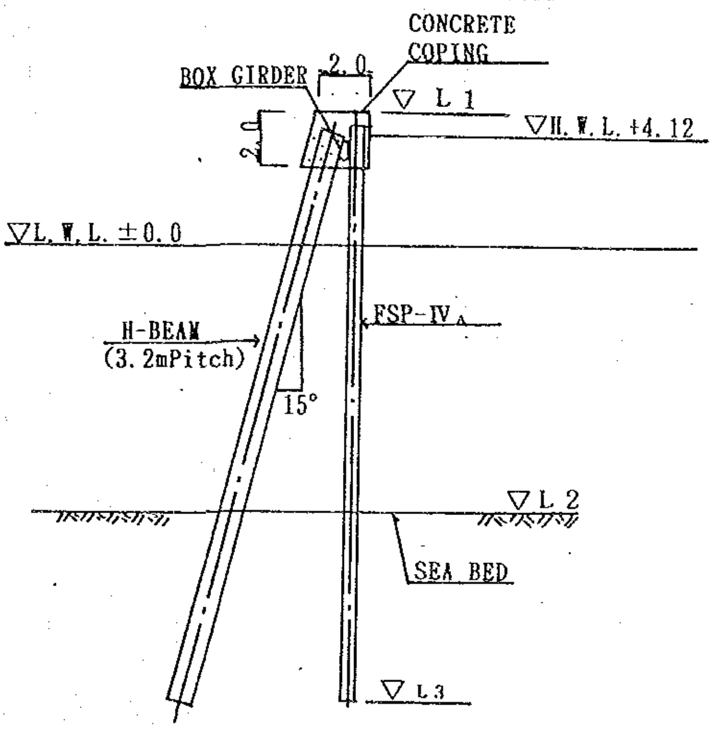
Fig. 5-4-1 Layout of Mooring Facilities of Mokmer Ferry Terminal

RUBBLE MOUND TYPE



No.	TERMINAL NAME	HEIGHT h(m)	LEVEL(m) L1	L2	REMARKS
1	MOKMER	1.0 ~ 8.0	+3.0	+2.0 ~ -5.0	
2	SAUBEBA	0.0 ~ 8.0	+3.0	+3.0 ~ -5.0	

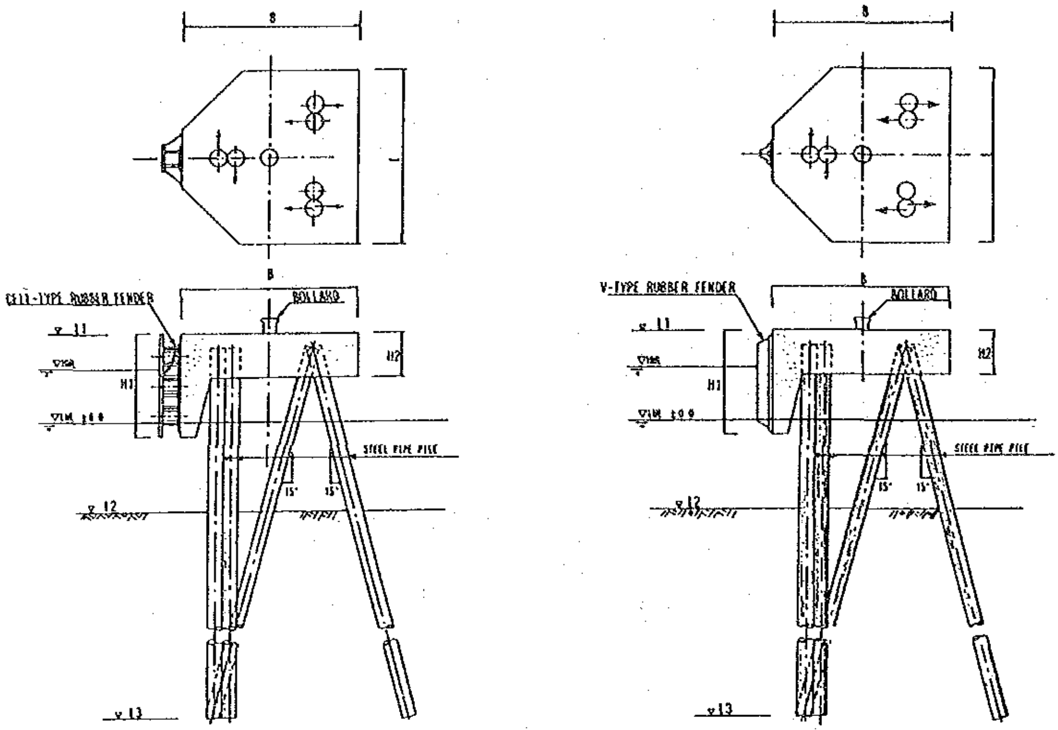
CURTAIN WALL TYPE



No.	TERMINAL NAME	WIDTH B(m)	HEIGHT(m) h	LEVEL(m) L1	L2	L3	REMARKS
8	MUNTOK	2.0	2.0	+5.0	-10.0	-16.0	

Fig. 5-4-2 Typical Cross Section of Breakwater and Groin

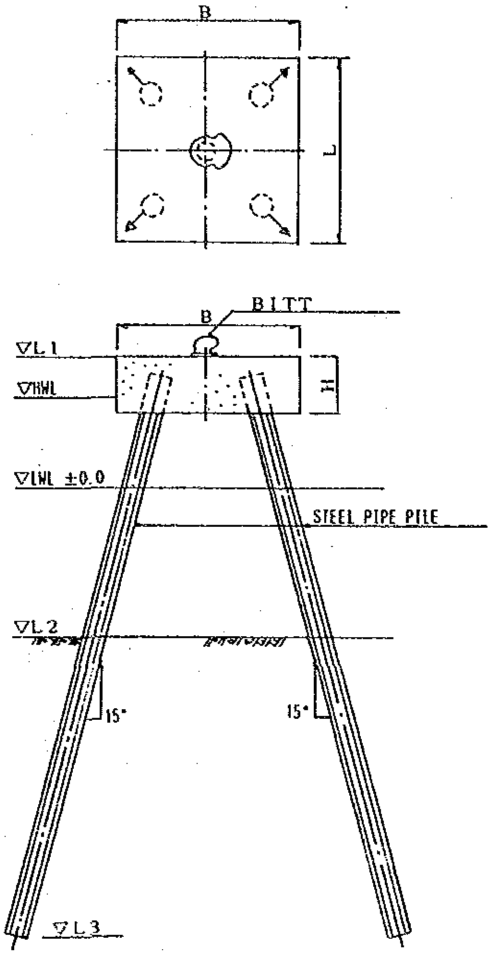
STEEL PILE TYPE



No.	TERMINAL NAME	PILE	WIDTH B(m)	LENGTH L(m)	HEIGHT(m) H1	H2	LEVEL(m) L1	L2	L3	ACCESSORIES FENDER	BOLLARD
1	MOKMER	φ400, t=12	4.0	4.0	3.0	1.5	+2.5	-3.0	-9.0	V-TYPE 400HX 2.5m	15t
2	SAUBEBA	φ400, t=12	4.0	4.0	3.0	1.5	+2.5	-4.5	-10.5	V-TYPE 400HX 2.5m	15t
3	TERONG	———	——	——	—	—	—	—	——	———	———
4	LEWOLEBA	φ500, t=12	6.0	6.0	3.5	1.5	+3.0	-6.0	-18.0	CELL-TYPE 500HX 3Units	15t
5	BAJOE	φ600, t=12	6.0	6.0	3.5	1.5	+3.0	-4.0	-12.5	CELL-TYPE 630HX 3Units	15t
6	KOLAKA	φ800, t=12	6.0	6.0	3.5	1.5	+3.5	-4.5	-30.0	CELL-TYPE 630HX 3Units	25t
7	PALEMBANG	φ500, t=12	6.0	6.0	4.5	1.5	+4.5	-5.0	-20.0	CELL-TYPE 500HX 3Units	15t
8	MUNTOK	φ600, t=12	6.0	6.0	4.5	1.5	+5.0	-8.0	-16.0	CELL-TYPE 500HX 3Units	15t

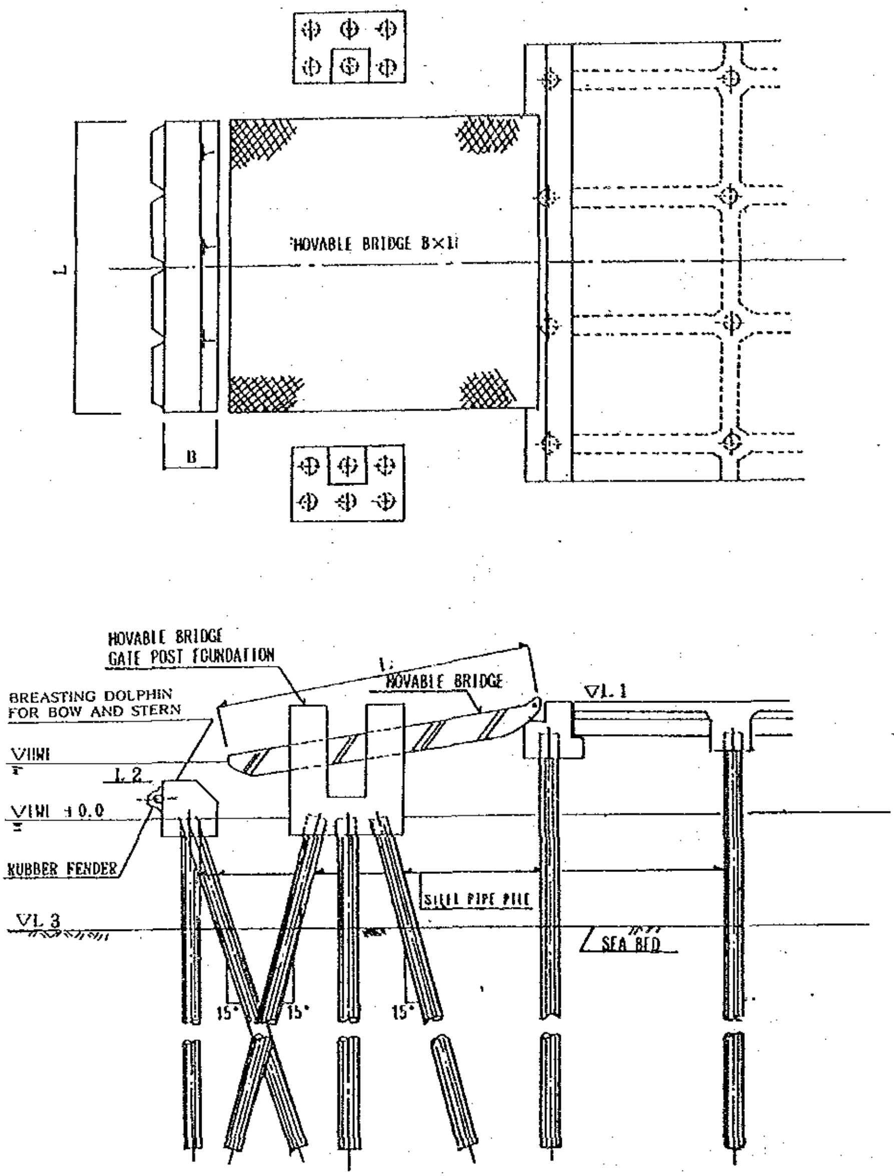
Fig. 5-4-3 Typical Cross Section of Breasting Dolphin

STEEL PILE TYPE



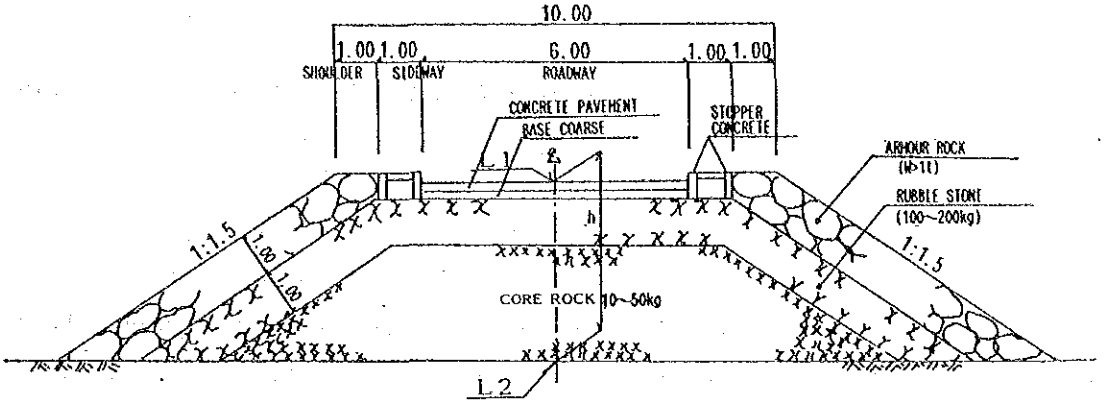
No.	TERMINAL NAME	PILE	WIDTH B(m)	LENGTH L(m)	HEIGHT H(m)	LEVEL(m)			ACCESSORIES BITT
						L1	L2	L3	
1	MOKMER	φ400, t=12	3.0	3.0	1.0	+2.5	-3.0	-9.0	15t
2	SAUBEBA	φ400, t=12	3.0	3.0	1.0	+2.5	-4.5	-10.5	15t
3	TERONG	———	——	——	——	——	——	——	———
4	LEWOLEBA	φ400, t=12	4.0	4.0	1.5	+3.0	-8.0	-20.5	15t
5	BAJOE	φ500, t=12	5.0	5.0	1.5	+3.0	-4.0	-11.5	25t
6	KOLAKA	φ600, t=12	5.0	5.0	1.5	+3.5	-5.5	-35.5	25t
7	PALEMBANG	φ400, t=12	4.0	4.0	1.5	+4.5	-6.5	-20.0	15t
8	MUNTOK	φ500, t=12	4.0	4.0	1.5	+5.0	-2.0	-16.0	15t

Fig. 5-4-4 Typical Cross Section of Mooring Dolphin



No.	TERMINAL NAME	H.W.L(m)	MOVABLE BRIDGE B X L	BREASTING DOLPHIN FOR BOW AND STERN B X W	LEVEL(m)			FENDER
					L1	L2	L3	
1	MOKMER	+1.55	7.0 X 8.0	1.5 X 7.0	+2.5	+0.9	-2.7	V-TYPE 300H 1.0mX 6Units
2	SAUDERA	+1.59	7.0 X 8.0	1.5 X 7.0	+2.5	+0.9	-2.7	V-TYPE 300H 1.0mX 6Units
3	TERONG	------	--------	----------	--	--	--	----------
4	LEWOLEBA	+2.14	8.0 X 11.0	1.5 X 8.0	+3.0	+0.9	-3.1	V-TYPE 400H 1.5mX 5Units
5	BAJOE	+2.32	9.0 X 12.5	1.5 X 9.0	+3.0	+1.0	-4.0	CELL-TYPE 630H 4 Units
6	KOLAKA	+2.53	9.0 X 17.0	1.5 X 9.0	+3.5	+1.0	-4.0	CELL-TYPE 630H 4 Units
7	PALEMBANG	+3.80	8.0 X 19.0	1.5 X 8.0	+4.5	+0.9	-3.1	V-TYPE 400H 1.5mX 5Units
8	MUNTOK	+4.12	8.0 X 22.0	1.5 X 8.0	+5.0	+0.9	-3.1	V-TYPE 400H 1.5mX 5Units

Fig. 5-4-5 Typical Cross Section of Movable Bridge



No.	TERMINAL NAME	HEIGHT h(m)	LEVEL(m)		REMARKS
			L1	L2	
1	MOKMER	1.5 ~ 2.0	+2.5	+1.0 ~ +0.5	
2	SAUBEBA	2.0 ~ 5.0	+4.0 ~ 2.5	+2.0 ~ -2.5	
3	TERONG	3.5 ~ 10.0	+4.0	+0.5 ~ -6.0	
4	LEWOLÉBA	2.0 ~ 3.0	+3.0	+1.0 ~±0.0	
5	BAJOE	----	----	----	
6	KOLAKA	----	----	----	
7	PALEMBANG	0.0 ~ 7.5	+2.6 ~ +4.5	+2.6 ~ -3.0	
8	MUNTOK	3.0 ~ 5.5	+4.5 ~ +5.0	+1.5 ~ -0.5	

Fig. 5-4-6 Typical Cross Section of Causeway

2) Saubeba Terminal

82. The detailed layout of the mooring facilities of Saubeba ferry terminal is shown in Fig. 5-4-7.

(1) Breakwater

83. The breakwater is designed to protect the mooring berth against W waves of H1/3=3.0m. The structural type of this breakwater was decided as a rubble mound type considering the wave height, water depth and availability of construction materials. The typical cross section is indicated in Fig. 5-4-2 and significant dimensions are as follows;

- Crown height	:	LWS + 3.0 m
- Crown width	:	3.0 m
- Slope gradient	:	Seaward 1:2, Harbor side 1:1.5
- Min. weight of armour stone	:	1.0 ton
- Max. water depth	:	LWS - 5.0 m
- Overall length	:	East 185 m, West 195 m

(2) Breasting Dolphins

84. Each breasting dolphin shall be able to absorb the same ship berthing energy as required for Mokmer, therefore the same type and size as for rubber fenders of Mokmer are installed. The structural type of breasting dolphins was also determined as the steel pipe pile type considering the sub-soil conditions of the terminal site.

85. The typical cross section of the dolphin is shown in on Fig. 5-4-3 and the significant dimensions are as follows;

- Super structure	: Reinforced concrete 4.0 m x 4.0 m x 1.5 to 3.0 m
- Foundation pile	: Steel pipe piles
	400 mm dia. x 12 mm thick x 12.5 m long x 6 pcs.
- Mooring post	: 15 ton

(3) Mooring Dolphin

86. Three(3) mooring dolphins are provided for this mooring berth and a mooring post of 15 ton tractive force is installed on each dolphin. The structural type was decided as steel pile type for the same reason as for the breasting dolphins. The typical cross section of the mooring dolphin is shown in Fig. 5-4-4 and the dimensions are as follows;

- Super structure : Reinforced concrete 3.0 m x 3.0 m x 1.0 m
- Foundation pile : Steel pipe piles
  400 mm dia. x 12 mm thick x 12.5 m long x 4 pcs.
- Mooring post : 15 ton

(4) Movable Bridge

87. The length of movable bridge was decided as 8.0 m based on the tidal range of 1.59 m, overlap of 1.0 m between ship ramp and movable bridge and the maximum gradient of 17 %. Width of the movable bridge was determined as 7.0 m as recommended in Chapter 6 of Part 2.

(5) Landing Deck

88. The landing deck in Saubeba is the same structural type and size as for the Mokmer terminal. The typical cross section of movable bridge, breasting dolphin at the bow side and landing deck is illustrated in Fig. 5-4-5.

(6) Access Way

89. The access way in Saubeba consists of a causeway at the shallow water area and a trestle at the deep water area. The lengths of causeway and trestle have been decided as 45 m and 52 m respectively based on the economical point of view. The typical cross section of the causeway and trestle are shown in Fig. 5-4-6 and Fig. 5-4-8 respectively.

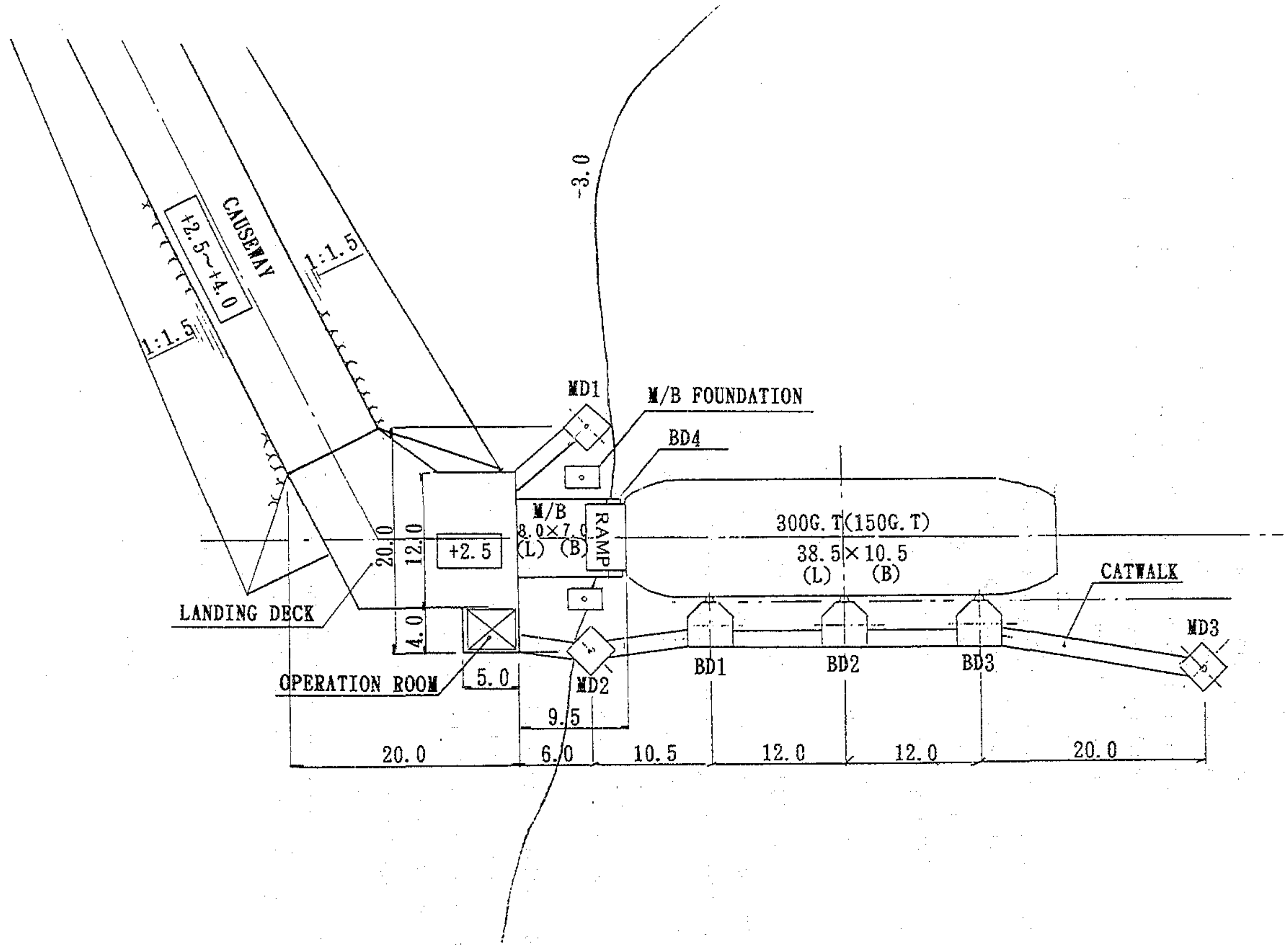
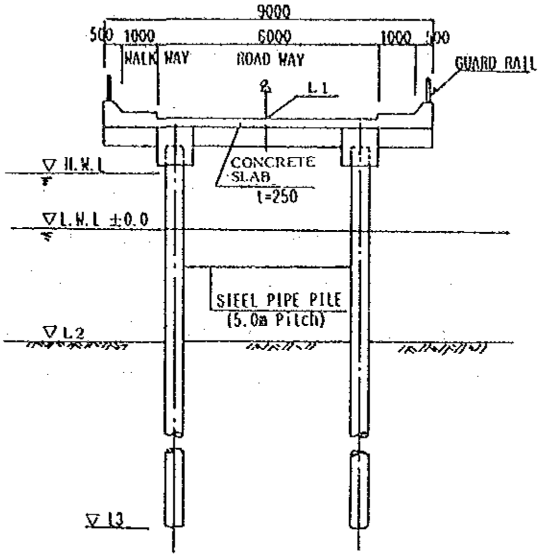


Fig. 5-4-7 Layout of Mooring facilities of Saubeba Ferry Terminal



No.	TERMINAL NAME	PILE	LEVEL(m)			REMARKS
			L1	L2	L3	
1	MOKMER	———	———	———	———	
2	SAUBEBA	———	———	———	———	
3	TERONG	———	———	———	———	
4	LEWOLEBA	φ400, t=12	+3.0	+3.0	-19.0	
5	BAJOE	φ400, t=12	+3.0	+3.0	-11.5	
6	KOLAKA	φ400, t=12	+4.0 ~ +3.0	+4.0 ~ +3.0	-25.0	
7	PALEMBANG	———	———	———	———	
8	MUNTOK	φ400, t=12	+5.0	+5.0	-16.0	

Fig. 5-4-8 Typical Cross Section of Trestle

3) Terong Terminal

90. The detailed layout of the mooring facilities of Terong ferry terminal is shown in Fig. 5-4-9.

91. Since this terminal site was selected after boring work had been completed on the opposite side of the sea port, the design was conducted assuming that the subsoil conditions are the same at both location. Therefore, prior to commencement of the detailed design, the design criteria on subsoil conditions should be reviewed based on new boring data to be obtained.

(1) Breasting Dolphins

92. Each breasting dolphin along the ship side shall be able to absorb the ship's berthing energy of 2.40 ton*m, therefore, 3 units of Cell-type rubber fenders of 500 mm height will be installed. Reaction force of the fenders is 43.0 ton which will be withstood by the breasting dolphin. The structural type of the dolphin was determined as concrete caisson type considering the sub-soil conditions of the terminal site.

93. As explained in Chapter 6 of Part 2, three (3) breasting dolphins are provided along ship side in order to accommodate not only 500 GRT ferry boats but also smaller ferry boats. The typical cross section of the dolphin is shown in Fig. 5-4-10 and the significant dimensions are as follows;

- Caisson structure : Reinforced concrete 5.0 m x 5.0 m x 7.50 m
- Mooring post : 15 ton

94. The breasting structure at the bow side is designed to be able to absorb a berthing energy of 1.80 ton*m, and 6 pieces of V-type rubber fenders 400 mm high and 1.5 m long will be installed. Reaction force of the fender of 22.5ton will be withstood by the breasting dolphin. Gravity type of structure was adopted for this structure due to the subsoil condition.

(2) Mooring Dolphin

95. Three(3) mooring dolphins are provided for this mooring berth and a mooring post of15ton tractive force is installed on each dolphin. The structural type was decided as concrete caisson type for the same reason as for the breasting dolphin. The typical cross section of the mooring dolphin is shown in Fig. 5-4-10 and the dimensions are as follows;

- Concrete structure : Reinforced concrete 4.0 m x 4.0 m x 7.5 m
- Mooring post : 15 ton

(3) Movable Bridge

96. The length of movable bridge was decided as 16.0 m based on the tidal range of 2.95 m, overlap of 1.0 m between ship ramp and movable bridge and the maximum gradient of 17 %. Width of the movable bridge was determined as 8.0 m as recommended in Chapter 6 of Part 2.

(4) Landing Stage

97. A landing stage 13 m wide and 20 m long is provided behind the movable bridge. This stage is made of concrete retaining wall and slab on filled soil. Top elevation of the stage has been determined as 4.0 m above LWS considering the tidal range and wave condition.

98. The typical cross section of movable bridge, breasting structure at the bow side and landing stage is illustrated in Fig. 5-4-11.

(5) Access Way

99. The access way to connect the on-land terminal facilities and the landing stage of the mooring facility is a causeway 30 m in length because the water depth is shallow and the subsoil has enough bearing capacity. The width of access way has been decided as 8.0 m consisting of two(2) vehicle lanes amounting to 6.0 m and 1.0 m sidewalks at both sides. The typical cross section of the causeway is shown in Fig. 5-4-6.

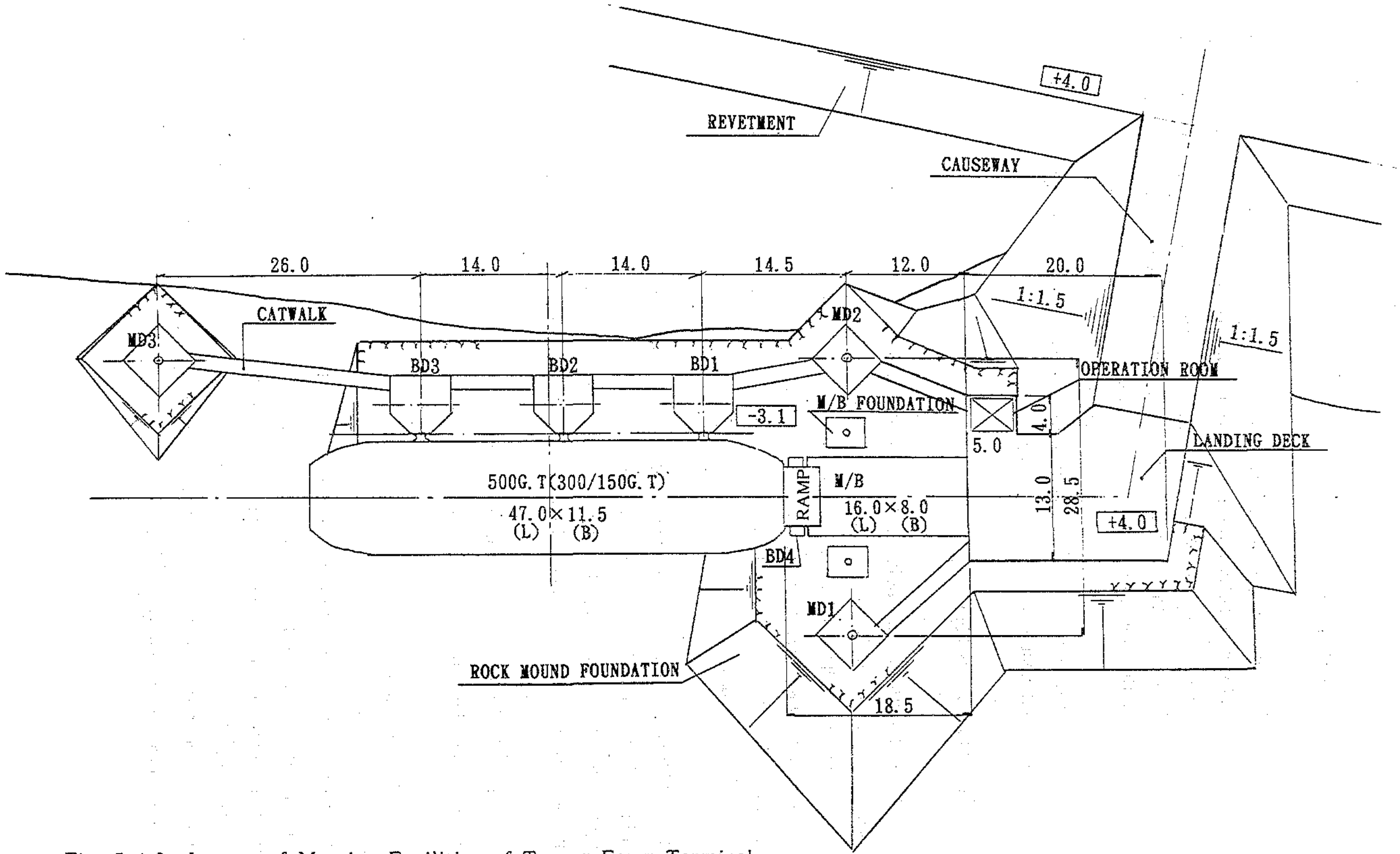
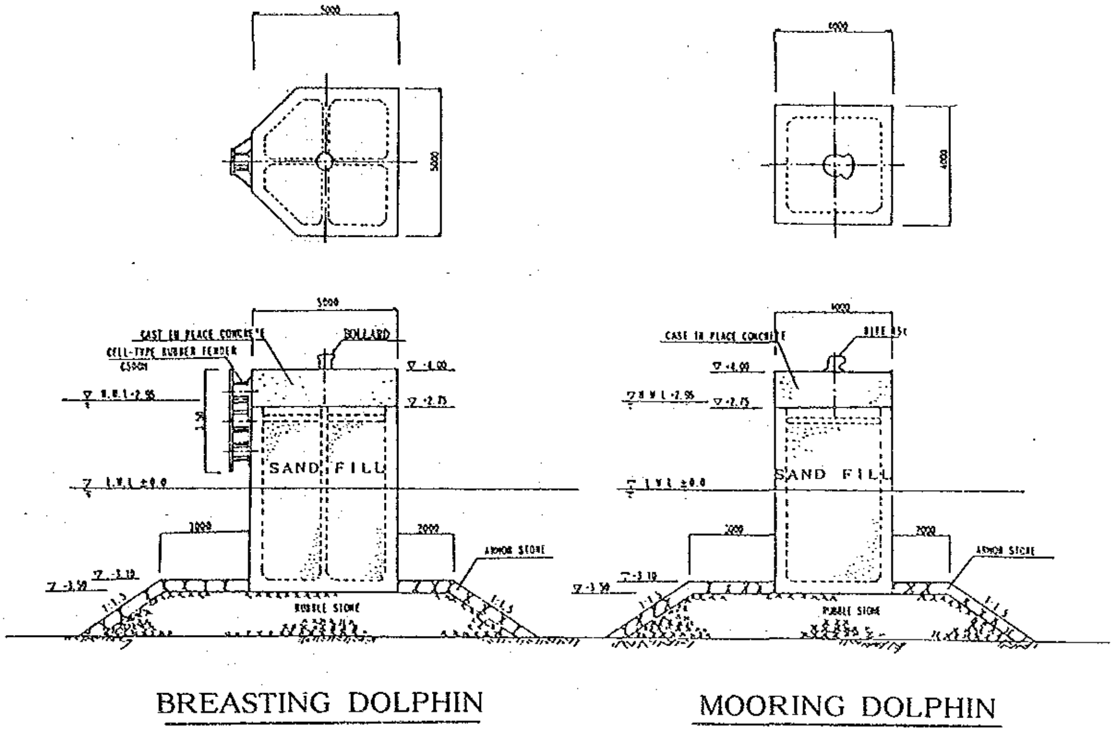
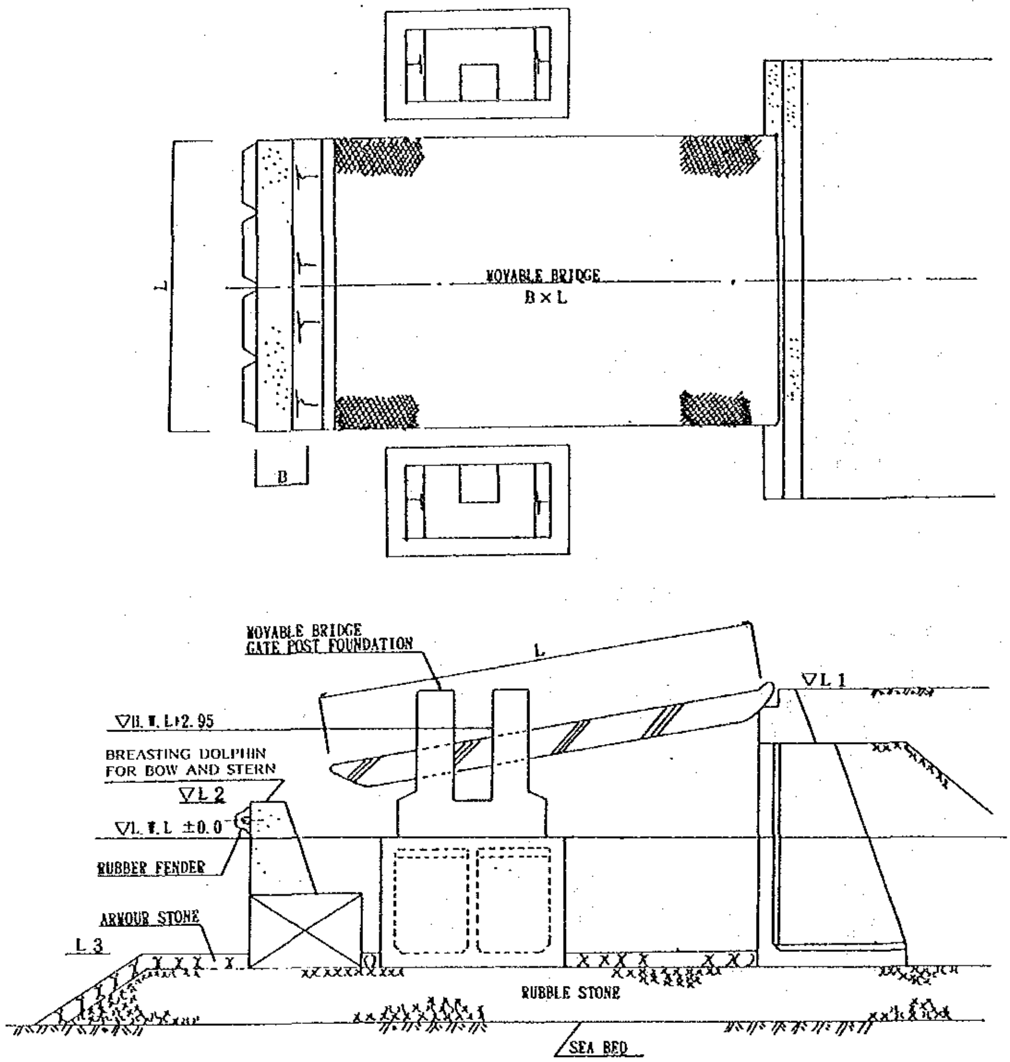


Fig. 5-4-9 Layout of Mooring Facilities of Terong Ferry Terminal



No.	TERMINAL NAME	BREASTING DOLPHIN		MOORING DOLPHIN
		FENDER	BOLLARD	BITT
3	TERONG	CELL-TYPE 500H X 3Units	15t	15t

Fig. 5-4-10 Typical Cross Section of Caisson Type Breasting Dolphin and Mooring Dolphin



NO.	TERMNAL NANE	H.W.L(m)	MOVABLE BRIDGE B X L	BREASTING DOLPHIN FOR BOW AND STERN B X L	LEVEL(m)			FENDER
					L1	L2	L3	
3	TERONG	+2.95	8.0 X 16.0	1.5 X 8.0	+4.0	+0.9	-3.1	V-TYPE 400H 1.5mX 5Units

Fig. 5-4-11 Typical Cross Section of Movable Bridge

4) Lewoleba Terminal

100. The detailed layout of the mooring facilities of Lewoleba ferry terminal is shown in Fig. 5-4-12.

(1) Breasting Dolphins

101. Each breasting dolphin along the ship side shall be able to absorb the same ship berthing energy as required at Terong, therefore at same type and size rubber fenders as for Terong are installed. However, the structural type of breasting dolphins has been determined not as a concrete caisson type but as a steel pile type, considering the sub-soil conditions of the terminal site.

102. The typical cross section of the dolphin along ship side is shown in Fig. 5-4-3 and the significant dimensions are as follows;

- Super structure : Reinforced concrete 6.0 m x 6.0 m x 1.5 to 3.5 m
- Foundation pile : Steel pipe piles
  500 mm dia. x 12 mm thick x 20.5 m long x 6 pcs.
- Mooring post : 15 ton

103. The typical cross section of the dolphin at bow side is shown in Fig. 5-4-5 and the significant dimensions are as follows;

- Super structure : Reinforced concrete 2.0 m x 1.0 m x 10 m
- Foundation pile : Steel pipe piles
  400 mm dia. x 12 mm thick x 22.0 m long x 6 pcs.

(2) Mooring Dolphin

104. Three(3) mooring dolphins are provided for this mooring berth and a mooring post of 15ton tractive force is installed on each dolphin. The structural type was decided as steel pile type for the same reason as for the breasting dolphin. The typical cross section of the mooring dolphin is shown in Fig. 5-4-4 and the dimensions are as follows;

- Super structure : Reinforced concrete 4.0 m x 4.0 m x 1.5 m

- Foundation pile : Steel pipe piles
  400 mm dia. x 12 mm thick x 23.0 m long x 4 pcs.
- Mooring post : 15 ton

(3) Movable Bridge

105. The length of movable bridge was decided as 11.0 m based on the tidal range of 2.14 m, overlap of 1.0 m between ship ramp and movable bridge and the maximum gradient of 17 %. Width of the movable bridge was determined as 8.0 m as recommended in Chapter 6 of Part 2.

(4) Landing Deck

106. The landing deck in Lewoleba is 13 m wide and 20 m long, consisting of concrete beams and slab supported by steel pipe piles of 500 mm dia. The typical cross section of movable bridge, breasting dolphin at bow side and landing deck is illustrated in Fig. 5-4-5.

(5) Access Way

107. The access way in Lewoleba consists of a causeway at the shallow water area and a trestle at the deep water area. The length of causeway and trestle have both been decided as 10 m based on the economical point of view. The typical cross section of the causeway and trestle are shown in Fig. 5-4-6 and Fig. 5-4-8 respectively.

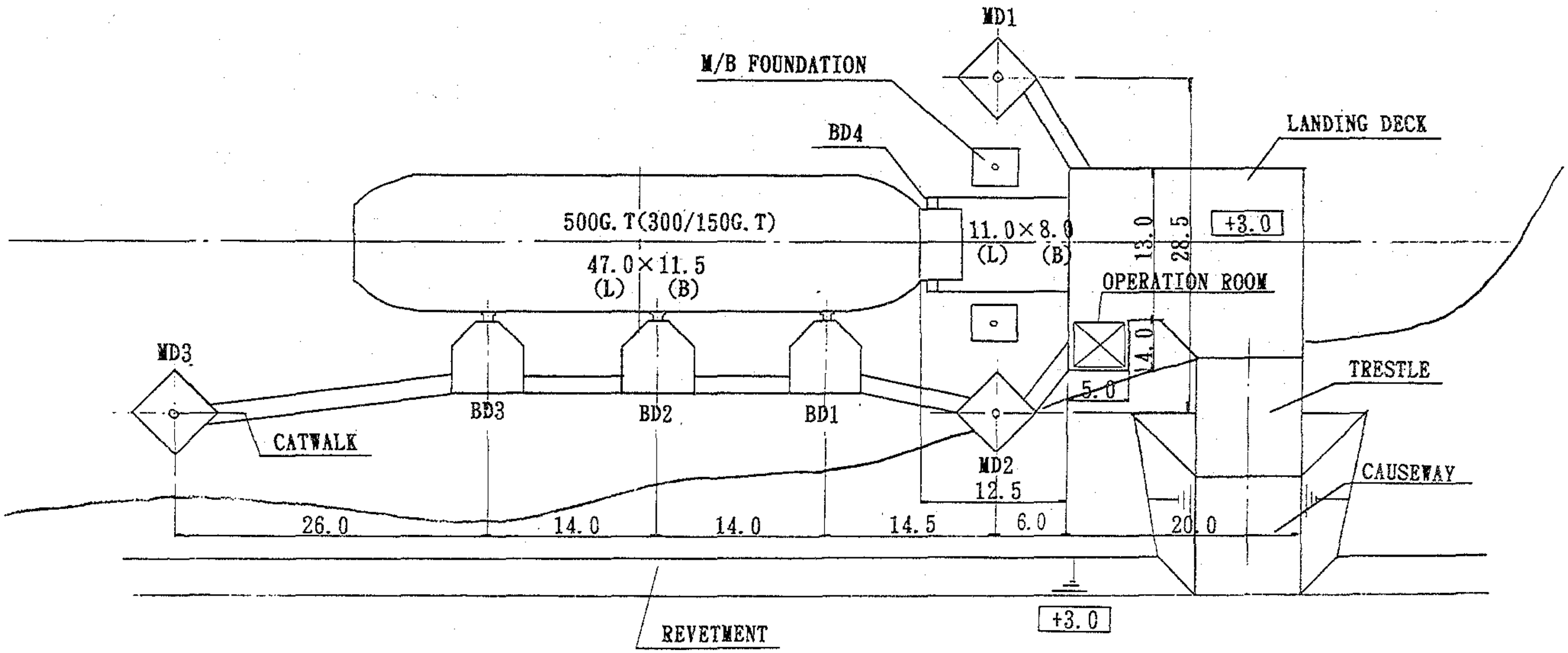


Fig. 5-4-12 Layout of Mooring Facilities of Lewoleba Ferry Terminal

5) Bajoe Terminal

108. The detailed layout of the mooring facilities of Bajoe ferry terminal shown in Fig. 5-4-13.

(1) Berth/Turning Basin/Approach Channel

109. The planned ferry boats (1000 GRT) require a water depth of more than 4.0 m, however the water depth around the existing mooring berth is only 3 m. To obtain the water depth of 4.0 m without dredging, it is necessary to extend the access way by about 500 m but the existing access way is already about 3000 m long. Therefore, it is recommended that the new moooring facility is built near the existing mooring berth and the required water depth for the berth, turning basin and approach channel obtained by dredging. The area to be dredged is shown in Fig. 5-4-13 and the dredging volume is estimated to be approximately 66,000 m^3.

(2) Breasting Dolphins

110. Each breasting dolphin along the ship side shall be able to absorb the ship's berthing energy of 5.85 ton*m, therefore, 3 units of Cell-type rubber fenders 630 mm in height will be installed. Reaction force of the fenders is 66.0 ton which will be withstood by the breasting dolphin. The structural type of the dolphin was determined as steel pile type considering the sub-soil conditions of the terminal site.

111. As explained in Chapter 6 of Part 2, three (3) breasting dolphins are provided along ship side in order to accommodate not only 1000 GRT ferry boats but also smaller ferry boats. The typical cross section of the dolphin is shown in Fig. 5-4-3 and the significant dimensions are as follows;

- Super structure : Reinforced concrete 6.0 m x 6.0 m x 1.5 to 3.5 m
- Foundation pile : Steel pipe pile
  600 mm dia. x 12 mm thick x 15 m x 6 pcs.
- Mooring post : 25 ton

112. The breasting dolphin at the bow side is designed to be able to absorb a

berthing energy of 4.54 ton*m, and 4 pieces of Cell type rubber fenders 630 mm high will be installed. Reaction force of the fenders of 90.0ton will be withstood by the breasting dolphin. The steel pile type of structure was also adopted for this structure due to the subsoil condition.

(3) Mooring Dolphin

113. Three (3) mooring dolphins are provided for this mooring berth and a mooring post of 25ton tractive force is installed on each dolphin. The structural type was decided as steel pile type for the same reason as for the breasting dolphin. The typical cross section of the mooring dolphin is shown in Fig. 5-4-4 and the dimensions are as follows;

- Super structure : Reinforced concrete 5.0 m x 5.0 m x 1.5 m
- Foundation pile : Steel pipe piles
  500 mm dia. x 12 mm thick x 14 m long x 4 pcs.
- Mooring post : 25 ton

(4) Movable Bridge

114. The length of movable bridge was decided as 12.5 m based on the tidal range of 2.32 m, overlap of 1.0 m between ship ramp and movable bridge and the maximum gradient of 12 %. Width of the movable bridge was determined as 9.0 m as recommended in Chapter 6 of Part 2.

(5) Landing Deck

115. A landing deck 16 m wide and 20 m long is provided behind the movable bridge. This deck consists of concrete beams and slab supported by steel pipe piles. Top elevation of the stage has been determined as 3.5 m above LWS considering the tidal range and wave conditions.

116. The typical cross section of movable bridge, breasting dolphin at the bow side and landing deck is illustrated in Fig. 5-4-5.

(6) Access Way

117. It has been decided that the access way to connect the existing causeway and the landing deck of the new mooring facility will be trestle made of concrete beams and slab on steel pile foundation, taking into consideration that this type of structure does not have an adverse influence on the littoral drift. The width of the access way has been decided as 8.0 m consisting of two (2) vehicle lanes amounting to 6.0 m and 1.0 m sidewalks at both sides. The typical cross section of the trestle is shown in Fig. 5-4-8.

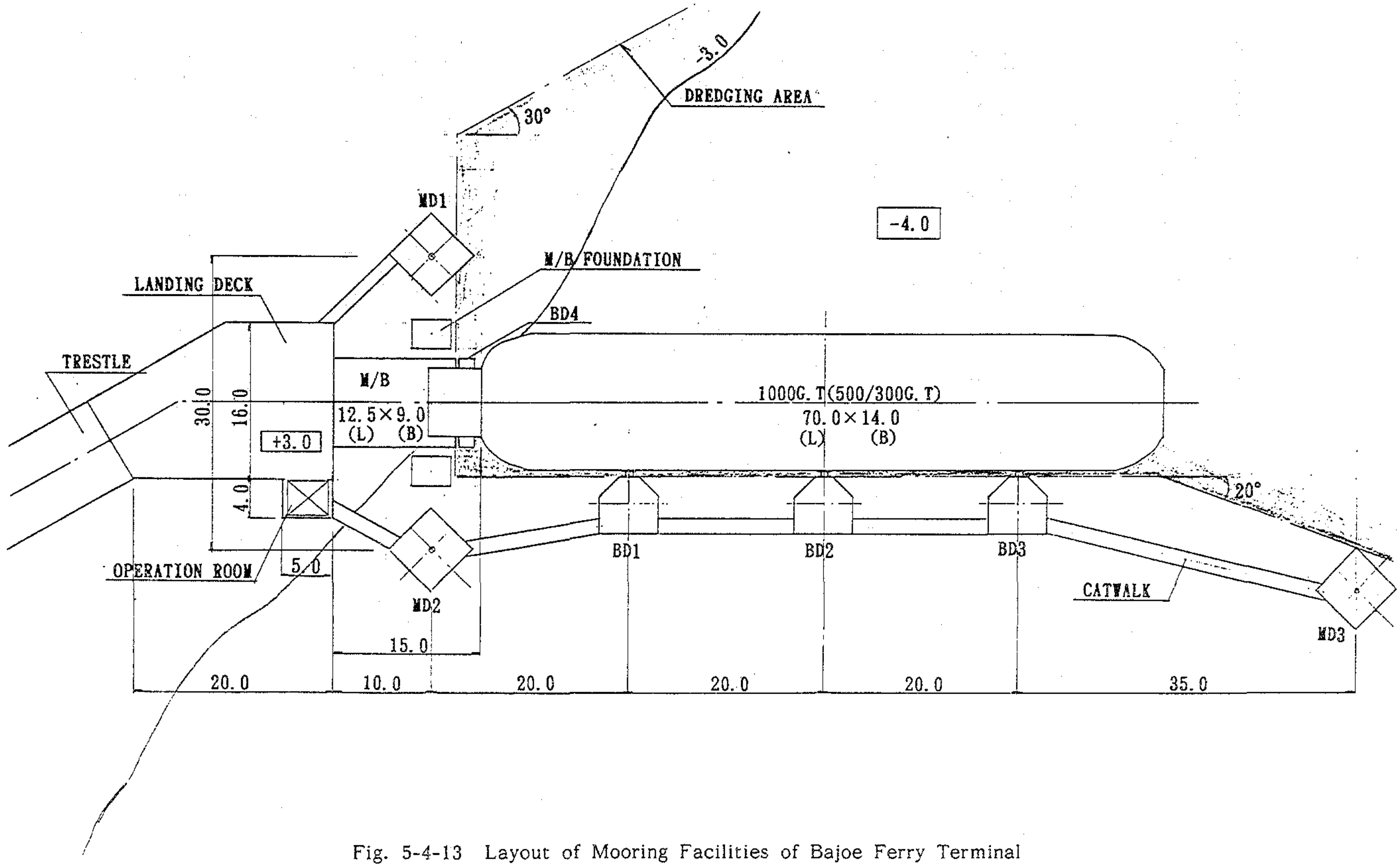


Fig. 5-4-13 Layout of Mooring Facilities of Bajoe Ferry Terminal

6) Kolaka Terminal

118. The detailed layout of the mooring facilities of Kolaka ferry terminal is shown in Fig. 5-4-14.

(1) Breasting Dolphins

119. Each breasting dolphin along ship side shall be able to absorb the same ship berthing energy as required for Bajoe, therefore the same type and size of rubber fenders as for Bajoe are installed. The structural type of breasting dolphins was determined also as steel pipe pile type considering the very poor sub-soil conditions of this terminal site.

120. The typical cross section of the dolphin along ship side is shown in Fig. 5-4-3 and the significant dimensions are as follows;

- Super structure : Reinforced concrete 6.0 m x 6.0 m x 1.5 to 3.5 m
- Foundation pile : Steel pipe piles
  800 mm dia. x 12 mm thick x 33.0 m long x 6 pcs.
- Mooring post : 25 ton

121. The breasting dolphin at the bow side is the same type of structure as for Bajoe except the size of foundation piles which are larger for Kolaka.

(2) Mooring Dolphin

122. Three (3) mooring dolphins are provided for this mooring facility and a mooring post of 25ton tractive force is installed on each dolphin. The structural type was decided as steel pile type for the same reason as for the breasting dolphin. The typical cross section of the mooring dolphin is shown in Fig. 5-4-4 and the dimensions are as follows;

- Super structure : Reinforced concrete 5.0 m x 5.0 m x 1.5 m
- Foundation pile : Steel pipe piles
  600 mm dia. x 12 mm thick x 38.0 m long x 4 pcs.
- Mooring post : 25 ton

(3) Movable Bridge

123. The length of movable bridge was decided as 17.0 m based on the tidal range of 2.53 m, overlap of 1.0 m between ship ramp and movable bridge and the maximum gradient of 12 %. Width of the movable bridge was determined as 9.0 m as recommended in Chapter 6 of Part 2.

(4) Landing Deck

124. The landing deck in Kolaka is 16 m wide and 20 m long, consisting of concrete beams and slab supported by steel pipe piles of 500 mm dia. The typical cross section of movable bridge, breasting dolphin at the bow side and landing deck is shown in Fig. 5-4-5.

(5) Access Way

125. The access way to connect the existing causeway and the landing deck of the new mooring facility is designed to be the trestle type of structure for the same reason as for Bajoe. The 105 m long trestle is necessary to obtain enough water depth for the new mooring berth. The typical cross section of the trestle is shown in Fig. 5-4-8.

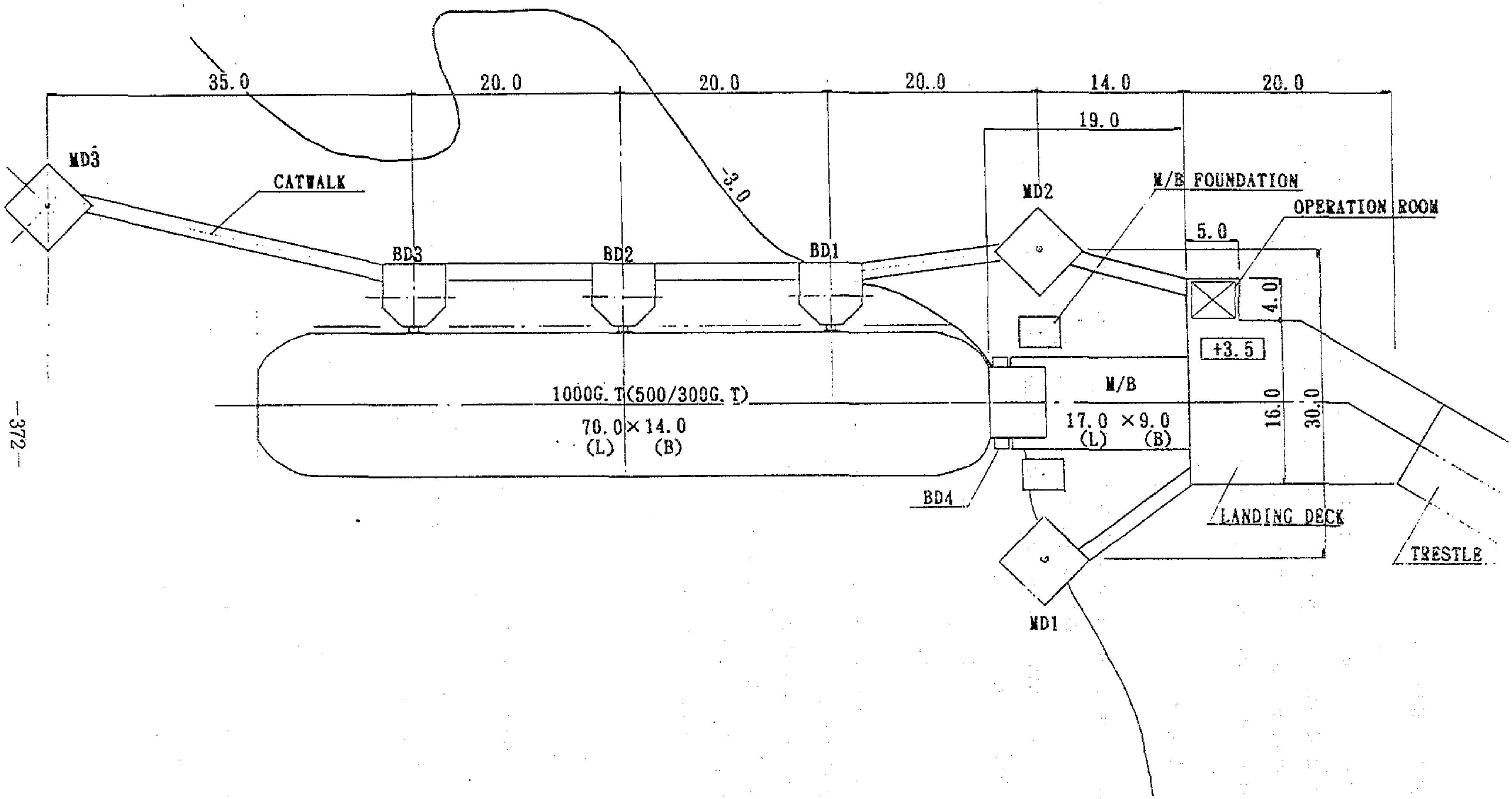


Fig. 5-4-14 Layout of Mooring Facilities of Kolaka Ferry Terminal

7) Palembang Terminal

126. The detailed layout of the mooring facilities of Palembang ferry terminal is shown in Fig. 5-4-15.

(1) Breasting Dolphins

127. Each breasting dolphin along the ship side shall be able to absorb the ship's berthing energy of 2.40 ton*m, therefore 3 units Cell type rubber fenders 500 mm high will be installed. Reaction force of the fenders is 43.0 ton which will be withstood by the breasting dolphin. The structural type of this dolphin has been determined as steel pile type considering the sub-soil conditions of the terminal site.

128. As explained in Chapter 6 of Part 2, three (3) breasting dolphins are provided along the ship side in order to accommodate not only 500 GRT ferry boats but also smaller ferry boats. The typical cross section of the dolphin is shown in Fig. 5-4-3 and the significant dimensions are as follows;

- Super structure : Reinforced concrete 6.0 m x 6.0 m x 1.5 to 4.5 m
- Foundation pile : Steel pipe piles
  600 mm dia. x 12 mm thick x 20.5 m long x 6 pcs.
- Mooring post : 15 ton

129. The breasting dolphin at the bow side is designed to be able to absorb the berthing energy of 1.80 ton*m, and 6 pieces of V-type rubber fenders 400 mm high and 1.5 m long will be installed. Reaction force of the fender of 22.5ton will be withstood by the breasting dolphin. The significant dimensions of the dolphin are as follows;

- Super structure : Reinforced concrete 2.0 m x 1.0 m x 10.0 m
- Foundation pile : Steel pipe piles
  500 mm dia. x 12 mm thick x 20.0 m long x 8 pcs.

(2) Mooring Dolphin

130. Three(3) mooring dolphins are provided for this mooring berth and a mooring post of 15 ton tractive force is installed on each dolphin. The structural type was decided as steel pile type for the same reason as for the breasting dolphins. The typical cross section of the mooring dolphin is shown in Fig. 5-4-4 and the dimensions are as follows;

- Super structure : Reinforced concrete 4.0 m x 4.0 m x 1.5 m
- Foundation pile : Steel pipe piles
  400 mm dia. x 12 mm thick x 24.0 m long x 4 pcs.
- Mooring post : 15 ton

(3) Movable Bridge

131. The length of movable bridge was decided as 19.0 m based on the tidal range of 3.80 m, overlap of 1.0 m between ship ramp and movable bridge and the maximum gradient of 17 %. Width of the movable bridge was determined as 8.0 m as recommended in Chapter 6 of Part 2.

(4) Landing Deck

132. A landing deck 13 m wide and 20 m long is provided behind the movable bridge. This deck is made of concrete beams and slab supported by steel pipe piles of 500 mm dia. Top elevation of the deck has been determined as 4.5 m above LWS considering the tidal range.

133. The typical cross section of movable bridge, breasting dolphin at the bow side and landing deck is illustrated in Fig. 5-4-5.

(5) Access Way

134. The access way to connect the on-land terminal facilities and the landing deck of the mooring facility is 28 m long and is a trestle because this type structure does not have an adverse effect on the river flow and the subsoil here has not enough bearing capacity for a causeway. The width of access way has benn decided as 8.0 m consisting of two (2) vehicle lanes amounting to 6.0 m and 1.0 m sidewalks at both sides. The typical cross section of the trestle is shown in Fig. 5-4-8.

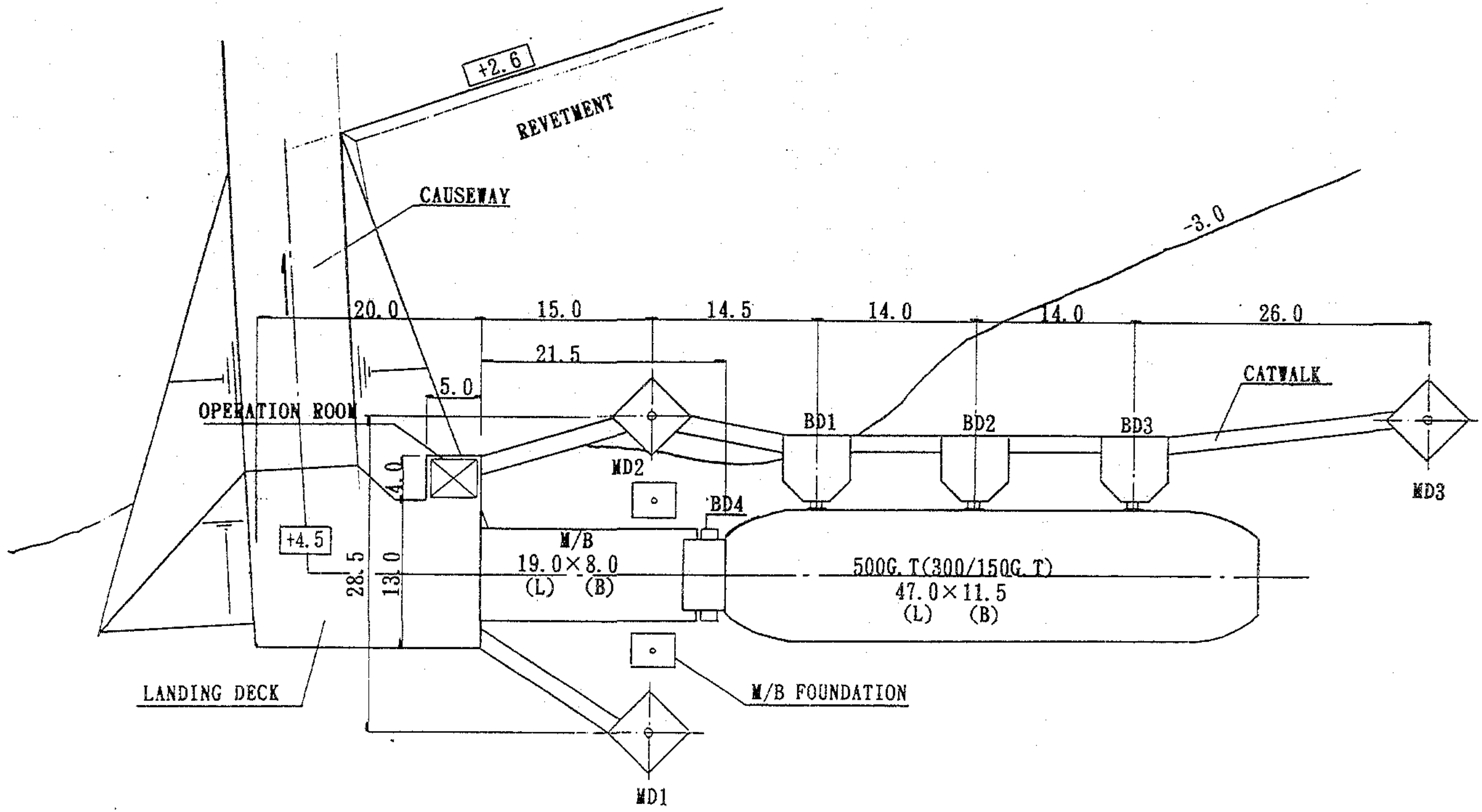


Fig. 5-4-15 Layout of Mooring Facilities of Palembang Ferry Terminal

8) Muntok Terminal

The detailed layout of the mooring facilities of Muntok ferry terminal is shown in on Fig. 5-4-16.

(1) Breakwater

135. The breakwater is designed to protect the mooring berth against SES waves of H1/3=1.0m. The structural type of this breakwater was decided as a curtain wall type considering the poor subsoil conditions, wave height and water depth. The typical cross section is shown in Fig. 5-4-2.

(2) Breasting Dolphins

136. Each breasting dolphin along ship side shall be able to absorb the same ship berthing energy as required for Palembang, therefore, the same type and size of rubber fenders as for Palembang are installed. The structural type of breasting dolphins was also determined as steel pipe pile type considering the sub-soil conditions of the terminal site.

137. The typical cross section of the dolphin is shown in Fig. 5-4-3 and the significant dimensions are as follows;

- Super structure	:	Reinforced concrete 6.0 m x 6.0 m x 1.5 to 4.5 m
- Foundation pile	:	Steel pipe piles 600 mm dia. x 12 mm thick x 20.5 m long x 6 pcs.
- Mooring post	:	15 ton

(3) Mooring Dolphin

138. Three(3) mooring dolphins are provided for this mooring berth and a mooring post of 15 ton tractive force is installed on each dolphin. The structural type was decided as steel pile type for by the same reason as for the breasting dolphins. The typical cross section of the mooring dolphin is shown in Fig. 5-4-4 and the dimensions are as follows;

- Super structure : Reinforced concrete 4.0 m x 4.0 m x 1.5 m

- Foundation pile : Steel pipe piles
  500 mm dia. x 12 mm thick x 20.5 m long x 4 pcs.
- Mooring post : 15 ton

(4) Movable Bridge

139. The length of movable bridge was decided as 22.0 m based on the tidal range of 4.12 m, overlap of 1.0 m between ship ramp and movable bridge and the maximum gradient of 17 %. Width of the movable bridge was determined as 8.0 m as recommended in Chapter 6 of Part 2.

(5) Landing Deck

140. The landing deck in Muntok is the same structural type and size as for the Palembang terminal. The typical cross section of movable bridge, breasting dolphin at bow side and landing deck is illustrated in Fig. 5-4-5.

(6) Access Way

141. The access way in Muntok consists of a causeway at the shallow water area and a trestle at the deep water area. The lengths of causeway and trestle have been decided as 20 m and 25 m respectively based on the economical point of view. The typical cross section of the causeway and trestle are shown in Fig. 5-4-6 and Fig. 5-4-8 respectively.

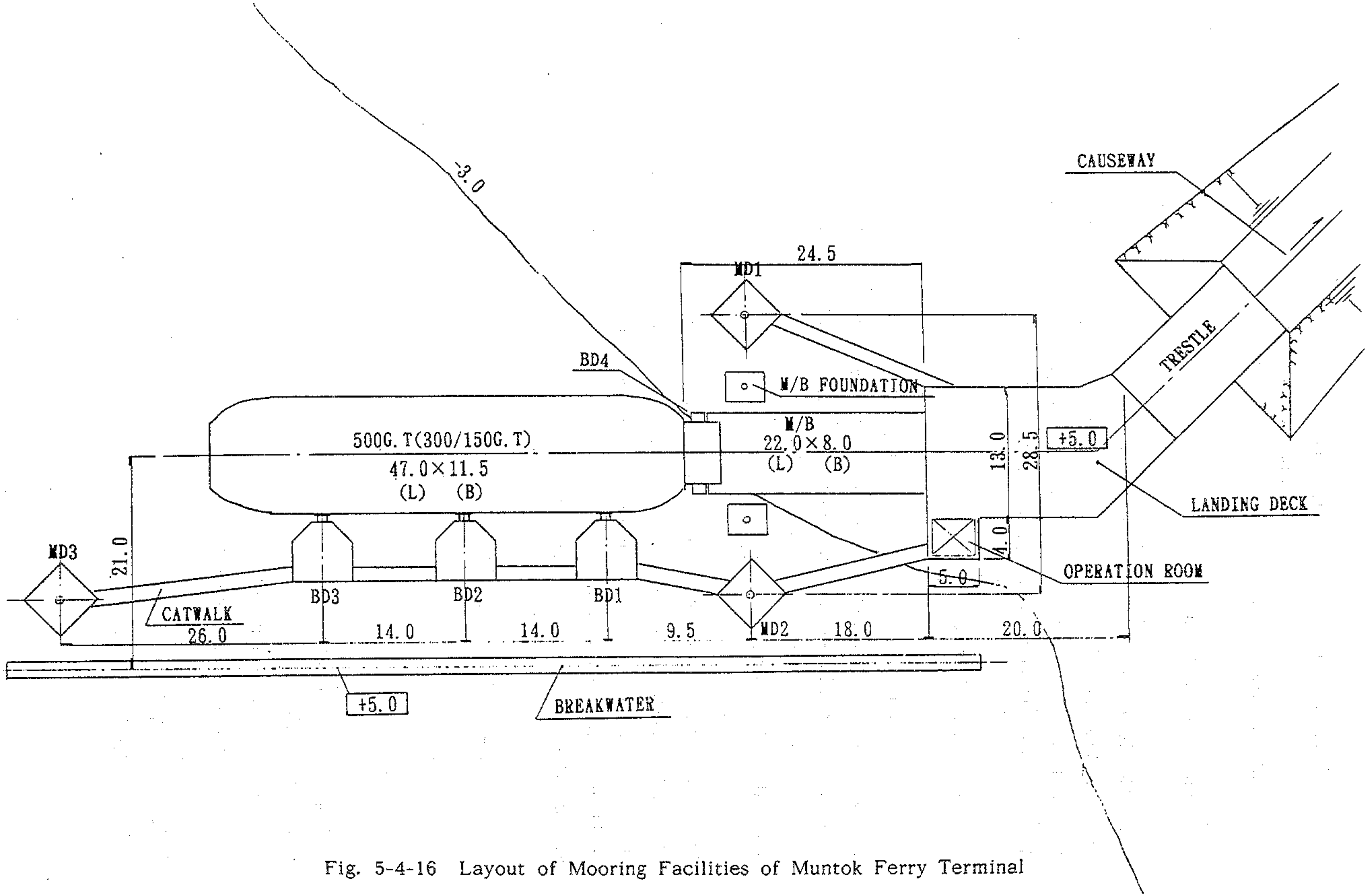
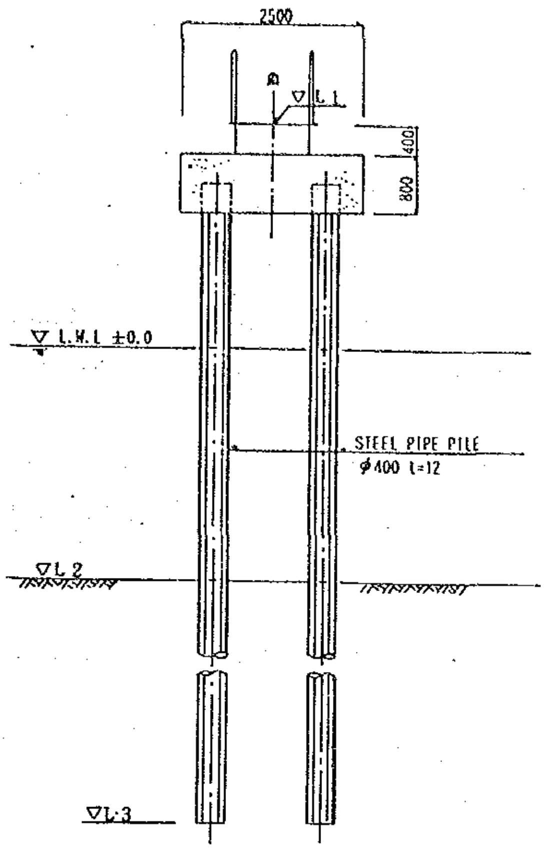


Fig. 5-4-16 Layout of Mooring Facilities of Muntok Ferry Terminal



No.	TERMINAL NAME	LEVEL(m)			REMARKS
		L1	L2	L3	
5	BAJOE	+3.0	-4.0	-11.0	
6	KOLAKA	+3.5	-7.0	-25.0	

Fig. 5-4-17 Typical Cross Section of Catwalk

5-4-3 Passenger Terminal Building

1) General

142. In general the passenger terminal building should satisfy the following requirement;

- The terminal building is closely connected to land transportation, and
- Passengers can receive safe, smooth and comfortable services in the terminal building.

To realize these needs, the passenger building should be designed with due consideration for capacity of the ferry boats, frequency, concentration ratio and number of passengers.

143. The passenger terminal building should have the following facilities;

(1) Waiting room for passengers
(2) Kiosk and canteen
(3) Administration office and shipping companies' office
(4) Praying room (mushola)
(5) Toilet
(6) Storage room
(7) Public hall and passage

2) Space Demand

144. The required waiting room size is obtained by the following formula;

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

where, a1 : Required waiting room space (m^2)

a : Required space for one person

a = 1.2 m2 (All terminals)

n : Number of passengers per ferry boat

n = 300 (Mokmer, Saubeba, Terong, Lewoleba)

n = 600 (Bajoe, Kolaka)

n = 500 (Palembang, Muntok)

N : Berthing/deberthing ships in same time zone

N = 1 (All terminals)

x : Concentration ratio(Peak number of passengers in a day / Number of passengers per ferry boat)

x = 1.0 (Mokmer, Saubeba, Terong, Lewoleba, Palembang, Muntok)

x = 1.6 (Bajoe, Kolaka)

y : Fluctuation ratio (seasonal variation)

y = 1.2 (All terminals)

145. From the above calculation the size of the passenger waiting room of each terminal was determined as below;

- Mokmer, Saubeba, Terong, Lewoleba a1 = 450 m^2
- Bajoe, Kolaka a1 = 1,400 m^2
- Palembang, Muntok a1 = 750 m^2

146. It is planned that 15% of passenger waiting space is allocated as kiosk and canteen for terminal users.

- Mokmer, Saubeba, Terong, Lewoleba a2 = 70 m^2
- Bajoe, Kolaka a2 = 200 m^2
- Palembang, Muntok a2 = 120 m^2

147. The minimum space for administration office including shipping companies' office is decided as 15% of the passenger waiting space.

- Mokmer, Saubeba, Terong, Lewoleba a3 = 70 m^2
- Bajoe, Kolaka a3 = 200 m^2
- Palembang, Muntok a3 = 120 m^2

148. For the space of playing room, storage room, toilet, etc., 25% of (a1+a2+a3) is allocated.

- Mokmer, Saubeba, Terong, Lewoleba a4 = 150 m^2
- Bajoe, Kolaka a4 = 450 m^2
- Palembang, Muntok a4 = 250 m^2

149. About 15 to 20% of (a1+a2+a3+a4) is provided for passages, staircase and entrance hall.

- Mokmer, Saubeba, Terong, Lewoleba	a5 = 60 m^2
- Bajoe, Kolaka	a5 = 250 m^2
- Palembang, Muntok	a5 = 160 m^2

150. The total area of each terminal building was accordingly decided as follows;

- Mokmer, Saubeba, Terong, Lewoleba	A = 800 m^2
- Bajoe, Kolaka	A = 2,500 m^2
- Palembang, Muntok	A = 1,400 m^2

3) Room Arragement

151. All passenger buildings are planned to be one story buildings and layout of the building in each terminal is designed based on the above required floor space as shown in Fig. 5-4-18 to Fig. 5-4-20.

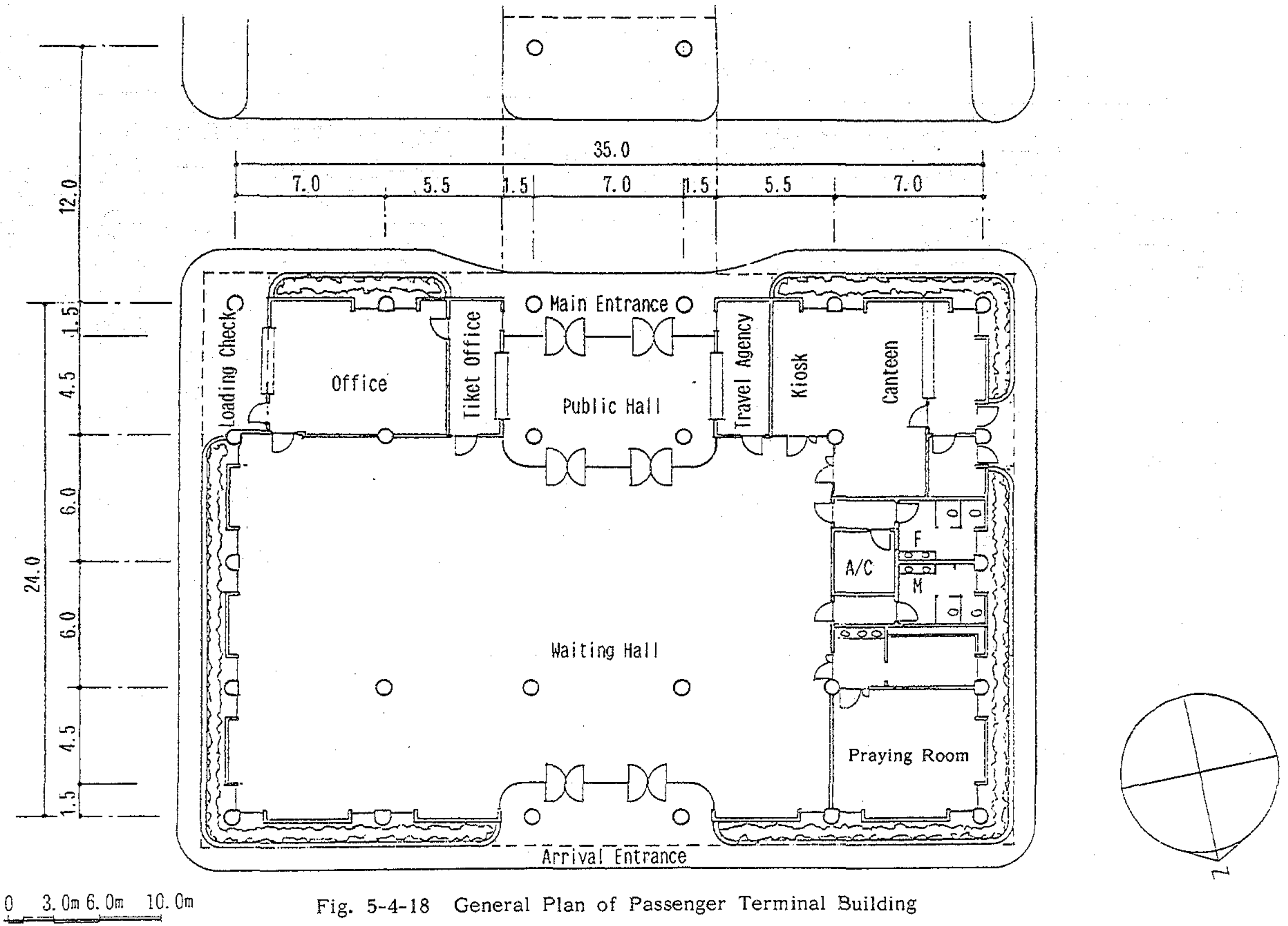


Fig. 5-4-18 General Plan of Passenger Terminal Building at Mokmer, Saubeba, Terong and Lewoleba

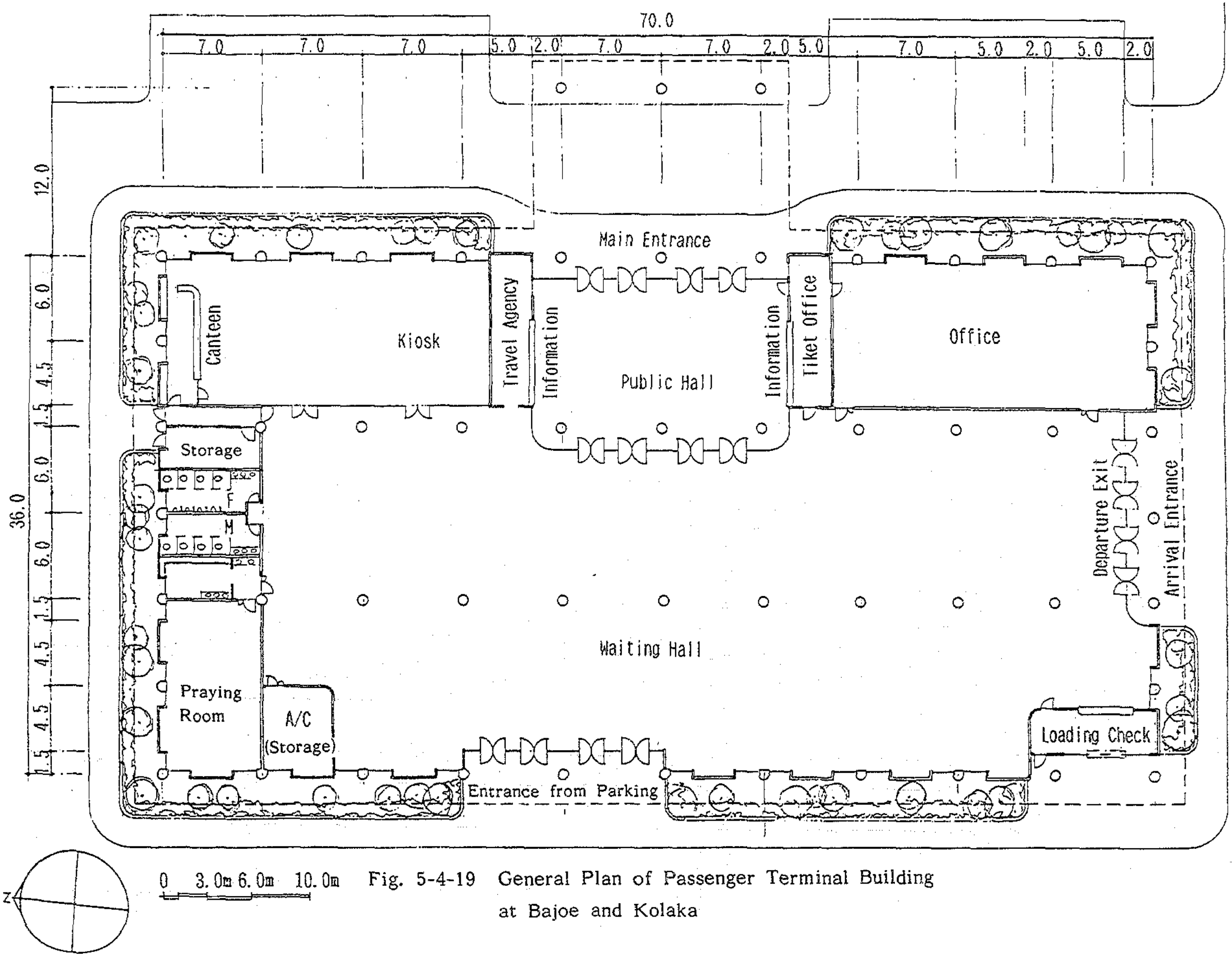


Fig. 5-4-19 General Plan of Passenger Terminal Building at Bajoe and Kolaka

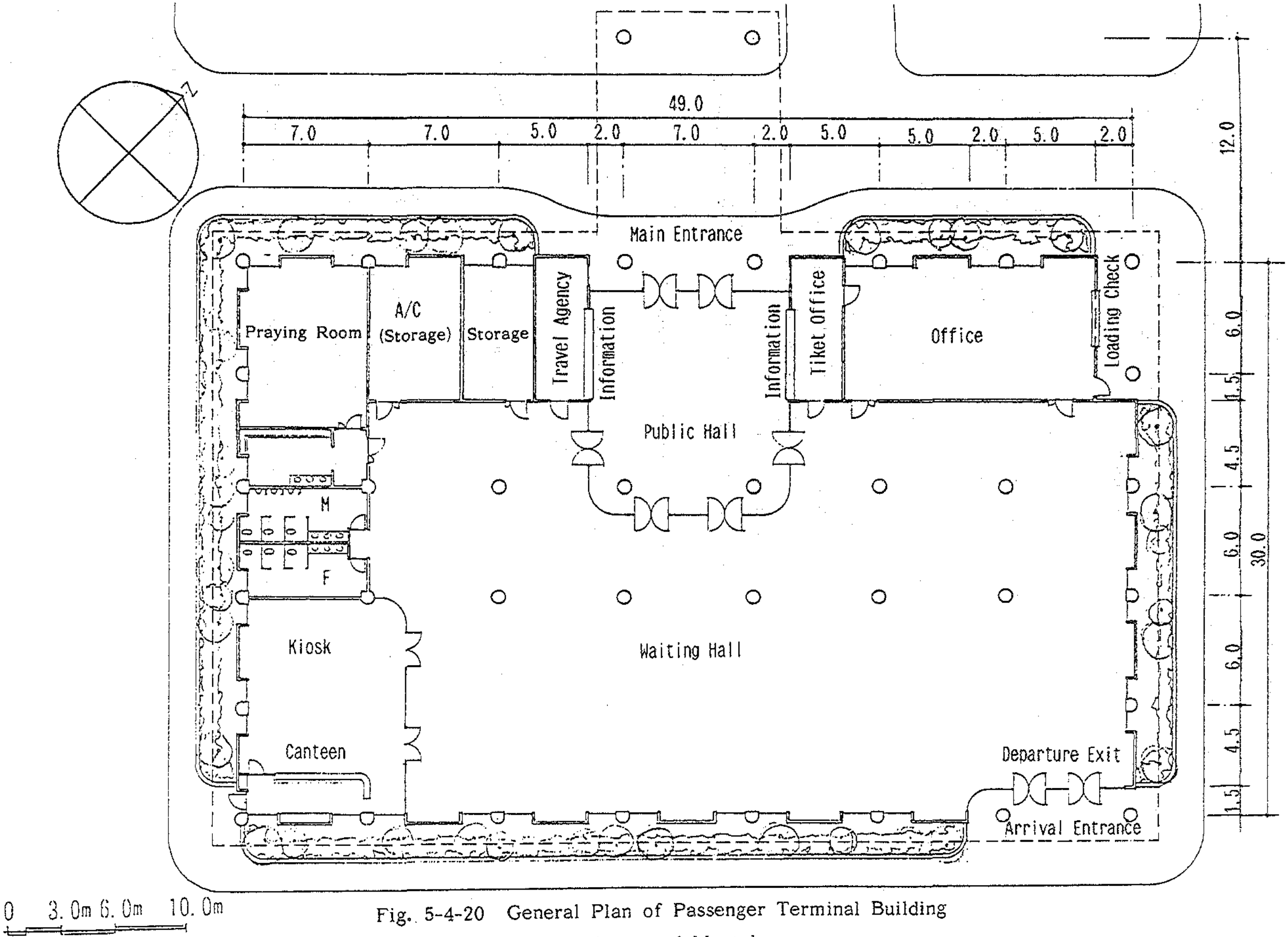


Fig. 5-4-20 General Plan of Passenger Terminal Building at Palembang and Muntok

5-4-4 Parking Lots

1) Loading Parking Lots

160. The area of required parking lots for vehicles ready for loading on to the ferry was obtained by the following formula;

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

where, A1 : Required parking area(m^2)

a : Required parking lot per vehicle(m^2)

8 ton truck a = 60 m^2 (Bajoe, Kolaka)

4 ton truck a = 45 m^2 (Other terminals)

n : Number of vehicles per planned ferry boat

n = 15 (Mokmer, Saubeba, Terong, Lewoleba)

n = 27 (Bajoe, Kolaka)

n = 20 (Palembang, Muntok)

N : Berthing/deberthing ships in same time zone

N = 1 (All terminals)

x : Utilization ratio (number of vehicles to use the parking lot: number of vehicles per ferry boat)

x = 1 (All terminals)

y : Fluctuation ratio (seasonal variation)

y = 1.2 (All terminals)

161. From the above formula the loading parking areas of the terminals were determined as follows;

- Mokmer, Saubeba, Terong, Lewoleba A1 = 650 m^2
- Bajoe, Kolaka A1 = 2,600 m^2
- Palembang, Muntok A1 = 950 m^2

162. Considering the following merits for construction and maintenance bituminous pavement is adopted for the loading parking lots.

- Bituminous pavemeny can cope with slight differential settlement of subgrade.
- Maintenance work is easy.

- Pavement work can be started soon after the reclamation work.

163. The composition of bituminous pavement was determined as shown below based on the load condition and subgrade condition.

	Mokmer Saubeba	Terong Lewoleba	Bajoe Kolaka	Palembang Muntok
Surface Course	5 cm	5 cm	5 cm	5 cm
Binder Course	-	-	10 cm	-
Base Course	15 cm	15 cm	15 cm	15 cm
Subbase Course	25 cm	25 cm	15 cm	25 cm

2) Waiting Parking Lots

164. The area of required parking lots for vehicles waiting for arriving passengers was obtained by the following formula;

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

where, A2 : Required parking area(m^2)

a : Required parking lot per vehicle(m^2)

Passenger vehicle a = 25 m^2 (All terminals)

n1 : Number of passengers per ferry boat

n = 300 (Mokmer, Saubeba, Terong, Lewoleba)

n = 600 (Bajoe, Kolaka)

n = 500 (Palembang, Muntok)

N : Berthing/deberthing ships in same time zone

N = 1 (All terminals)

x : Utilization ratio

x = 1 (All terminals)

y : Concentration ratio

y = 1.0 (Mokmer, Saubeba, Terong, Lewoleba, Palembang, Muntok)

y = 1.6 (Bajoe, Kolaka)

z : Utilization ratio of vehicle

z = 1.0

n2 : Number of passengers per vehicle

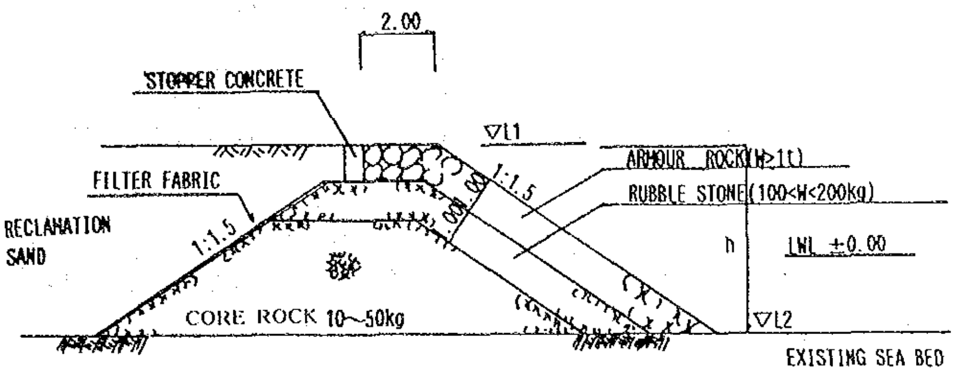
n2 = 8 (All terminals)

165. From the above formula the waiting parking areas of the terminals were determined as follows;

- Mokmer, Saubeba, Terong, Lewoleba A2 = 950 m^2
- Bajoe, Kolaka A2 = 3,000 m^2
- Palembang, Muntok A3 = 1,500 m^2

166. The same compositions of bituminous pavement as for the loading parking lots are adopted for the waiting parking lots and for the road pavement in the terminal area for all terminals.

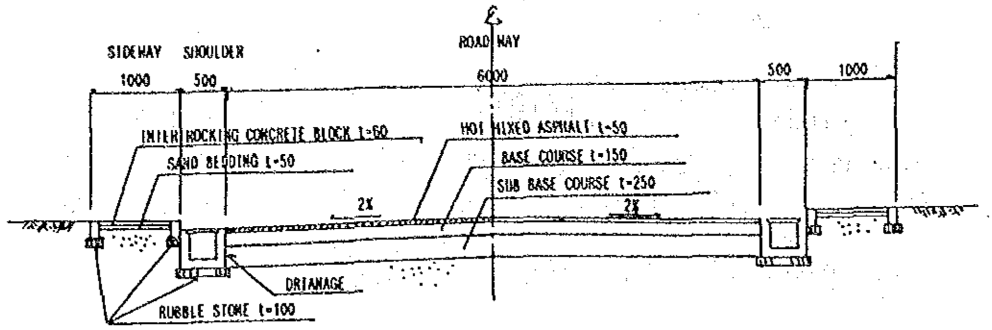
167. Typical cross sections of pavement of loading parking lots, waiting parking lots and terminal roads are shown in Fig. 5-4-22.



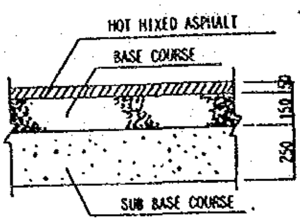
No	TERMINAL NAME	HEIGHT h(m)	LEVEL(m) L1	LEVEL(m) L2	REMARKS
1	MOKMER	0.5 ~ 1.5	+2.5	+2.0 ~ +1.0	
2	SAUBEBA	0.0 ~ 2.0	+4.0	+4.0 ~ +2.0	
3	TERONG	0.0 ~ 3.5	+4.0	+4.0 ~ +0.5	
4	LEWOLEBA	0.0 ~ 4.0	+3.0	+3.0 ~ -1.0	
5	BAJOE	3.0 ~ 5.0	+3.0	±0.0 ~ -2.0	
6	KOLAKA	2.0	+3.0	+1.0	
7	PALEMBANG	0.4	+2.6	+3.0	
8	MUNTOK	0.0 ~ 4.5	+4.5	+4.5 ~ ±0.0	

Fig. 5-4-21 Typical Cross Section of Revetment

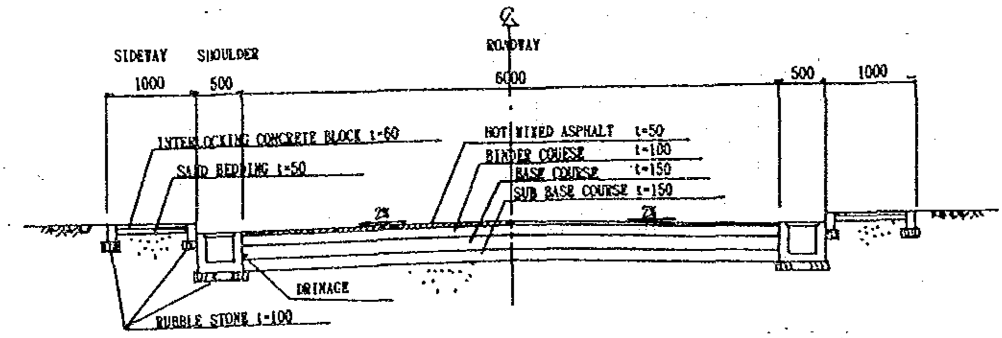
ROAD AND DRAINAGE



PARKING LOT



ROAD AND DRAINAGE
(Bajoe, Kolaka)



PARKING LOT
(Bajoe, Kolaka)

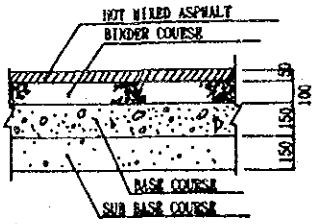


Fig. 5-4-22 Typical Cross Section of Pavement

5-4-5 Electricity and Water Supply

1) Electricity Supply

168. Lighting is provided for the passenger terminal building, parking lots, approach road and mooring facilities. Air-conditioning is not provided for passenger waiting room but is provided for the office and canteen in the passenger terminal building. Power supply for the movable bridge and water pump is also considered.

169. The required electricity is planned to be supplied by diesel engine generator sets installed in each terminal, since there is still probability of temporary breakdown of the PLN supply.

170. The electricity supply required in each terminal has been estimated as shown below;

(1) Mokmer, Saubeba, Terong, Lewoleba

- Lighting of terminal building	;	800 m2 * 50VA =	40 KVA
- Lighting of outdoor facilities	;	15 * 450VA =	7 KVA
- Air-conditioning	;	150 m2 * 100VA =	15 KVA
- Movable bridge	;		5 KVA
- Water pump	;		5 KVA
Total			72 KVA

Two (2) sets of 100 KVA diesel engine generator are recommended to be installed.

(2) Bajoe, Kolaka

- Lighting of terminal building	;	2500 m2 * 50 VA =	125 KVA
- Lighting of outdoor facilities	;	25 * 450 VA =	12 KVA
- Air-conditioning	;	200 m2 * 100 VA =	20 KVA
- Movable bridge	;		10 KVA
- Water pump	;		10 KVA
Total			177 KVA

Two (2) sets of 200 KVA diesel engine generator are recommended to be installed at each terminal.

(3) Palembang, Muntok

- Lighting of terminal building	;	1400 m2	*	50 VA	=	70 KVA
- Lighting of outdoor facilities	;	2	*	50 VA	=	9 KVA
- Air-conditioning	;	120 m2	*	100 VA	=	12 KVA
- Movable bridge	;					10 KVA
- Water pump	;					10 KVA
Total						111 KVA

Two (2) sets of 150 KVA diesel engine generator are recommended to be installed in each terminal.

2) Water Supply

171. Water is supplied for the staff of the terminal, for passengers and for the ferry boats. It is planned that the water required will be obtained by deep well to be drilled near each terminal site.

172. The well water is pumped up to an elevated reservoir tank and water is distributed to the passenger building and ferry boats from this elevated tank. The capacity of the reservoir tank is governed by the capacity of the ship's tank. It is assumed that the supply to the ship is provided once in every two calls, since the water can be supplied at the terminals on both sides of the route.

173. The water supply required at each terminal has been estimated as shown below;

(1) Mokmer, Saubeba, Terong, Lewoleba

- Staff	:	18 persons * 150 l/day =	2,700 l
- Passengers	:	300 persons* 2 times* 10 l/day =	6,000 l
- Ship	:		13,000 l
Total			21,700 l/day

(2) Bajoe, Kolaka

- Staff	:	40 persons * 150 l/day =	6,000 l
- Passengers	:	600 persons* 7 times* 10 l/day =	42,000 l
- Ship	:	50,000l*7times/2 =	175,000 l
Total			223,000 l/day

(3) Palembang, Muntok

- Staff	:	23 persons * 150 l/day =	3,450 l
- Passengers	:	500 persons* 4 times* 10 l/day =	20,000 l
- Ship	:	24,000 l * 4 times/2 =	48,000 l
Total			71,450 l/day

Chapter 6 Port Management and Operation Program

6-1 Principle for Decision of Port Tariff

1. Concerning public facilities, there are infrastructures such as roads which unspecified people use or those such as sea ports which may earn some profits by collecting charges from users. Setting the port tariff greatly depends on government policy. In particular, ferry ports in Indonesia are directly managed and operated by the government. The government considers ferry service as an extension of roads or as floating bridges. A lot of government funds are invested in ferry service facilities. The policy of ferry services development is slightly different from that of sea port development.

2. When establishing the tariff, the cost principle is often used. The following stages are considered in setting target levels.

(1) To collect ordinary operating expenses excluding maintenance costs.
(2) To collect ordinary operating expenses (including maintenance costs).
(3) In addition to the above, to collect construction costs of functional facilities.
(4) In addition to the above, to collect all construction costs.

3. Because the ferry service facilities can be also regarded as the facilities with specified users, partially financial independence has to be considered in the future.

4. For the financial analysis in this study, the port tariff is assumed to increase by 15% every five years. This value is equal to two thirds the increase of GDP per capita and is considered to be sufficiently feasible. Furthermore, the ordinary operating costs of the ferry port office will be recovered in about 30 years.

5. It is difficult to secure the maintenance costs at present, but may be more easier by increasing this port tariff.

6-2 Funds for Constructing the Ferry Port

6. Government funds from the general account have a great importance for public and fundamental facilities such as ferry ports. The effect on economy and human life seem to be immense.

7. Especially, Government funds play a great role in pioneering undeveloped areas.

8. Also, government funds are important in implementing this short-term plan. Furthermore, continuous government funds are necessary. Details are mentioned in the chapter on financial analysis.

6-3 Organization of the Port Management Body

6-3-1 Organization of Ferry Port Operation Office

9. Most ferry port operation offices are supervised by the head of the regional offices of MOC. The port operation offices are classified into two classes, Class II and Class III. The organization charts of port operation offices are shown in Tables 1-3-6A and 1-3-7A of Part I respectively.

10. In this Short-term Plan, all the port offices will be managed and operated by MOC just the same as the present ferry ports. And, we assume that this classification will also be applied to the planned ferry ports. Namely, the Bajoe office and the Kolaka office are classified as Class II, while the other offices, Mokmer, Saubeba, Larantuka, Terong, Lewoleba, Palembang and Muntok offices, as Class III.

6-3-2 Required Number of Personnel

11. The current number of personnel in the existing port operation offices for F/S routes are shown in Tables 6-3-1A and 6-3-2A.

12. In the Short-term Plan in 1998, the service frequencies are one round trips at Mokmer, Saubeba, Terong and Lewoleba, two round trips at Palembang and Muntok and three round trips at Bajoe and Kolaka.

13. The required number of personnel at each port operation office should be determined in accordance with ferry service frequencies during the project life.

14. Taking the number of personnel at the existing terminal office, mooring hours and round trips of ferryboat into account, the required number of personnel at each port office is considered as in Tables 6-3-3A and 6-3-4A at the commencement of ferry service in 1998.

15. For the economic and financial analysis in this study, the required number of personnel needs to be increased in accordance with the increased working volume. Concretely speaking, the number of personnel will be increased by one person per section at three or four sections (excluding the administration section) in the terminal office for one round of increased number of round trips of ferryboats.

6-4 Recommendations

16. Personnel training is very important for terminal administration and operation. Terminal staffs often have to pay attention to the efficiency and safety of terminal operations. Regular training sessions are required to ensure that each section functions smoothly.

17. Interchange of personnel among ferry terminals is important for spreading new ideas and information related to ferry service operations. Ideas which interchanged staff members have may be useful in improving the efficiency of terminal operations.

18. Maintenance of terminal facilities should be implemented more carefully. In general, the present budgets allocated for maintenance is too small. In particular, more funds should be allocated for maintaining reinforced concrete pier and machine such as the movable bridge.

19. Statistics related to traffic activities such as passengers, vehicles, cargo volume and ferryboat operations at a ferry terminal should be recorded and kept for a long period of time. To grasp not only present conditions but also past conditions is very important for the government, especially government planners. These data are very useful in drafting improvement plans or new plans.

Chapter 7 Cost Estimation and Construction Schedule

7-1 Cost Estimation

7-1-1 Assumptions for Cost Estimation

(1) General

1. The standardized type of ferry terminal facilities and the estimated scope of works of the ferry terminals selected for the Feasibility Study are reviewed based on the results of actual topographic, and hydrographic surveys and soil investigation.

2. The construction cost of the works estimated previously for the Master Plan are reviewed by using the same basic construction costs as of 1992 with the exchange rate of 16.12 Rp./Yen. (1 US$ = 125 Yen, = 2015 Rp.).

Accordingly the construction costs of the works are adjusted depending on the type of the structures, their foundation, and magnitude of the works.

(2) Basic Assumptions for Cost Estimation

3. The cost estimation of each ferry terminal is determined with the assumption that the construction of the two terminals in one route will be carried out by one packaged contract.

4. The necessary engineering study for surveys,investigation and design for 4 routes, 8 terminals, as one package will be conducted prior to the commencement of the construction works.

5. The implementation period of the construction of each route is estimated to be three years with the following sequence;

First year; Engineering studies for surveys, investigation and detailed design including the preparation of tender documents, and the tender up to the award of contract.

Second and

Third year; Construction works of two terminals.

(3) Basic Construction Cost of the Planned Facilities

6. The following basic construction costs as of 1992 at the respective provinces are used for the cost estimation of the planned facilities determined by the basic design.

They are the same basic construction costs of the works and materials costs as applied for the cost estimate of the Master Plan.

Table 7-1-1 Basic Construction Cost of the Works

Unit: Rupiah

Works	Route No. and Ferry Terminals				
Route No;	2		3	8	9
Name of Ferry Terminal	Mokumer/Saubeba		Leworeba/ Terong	Kolaka/ Bajoe	Palembang/ Muntok
Concrete works(sq.m)	mil 0.96	mil 1.20	mil 1.20	mil 0.90	mil 0.85
Pile material(ton)	2,300	2,875	2,250	2,250	2,250
Pile driving (m)	mil 0.09	mil 0.1125	mil 0.115	mil 0.10	mil 0.105
Pavement works (sq.m)	mil 0.044	mil 0.055	mil 0.050	mil 0.045	mil 0.036
Building works (sq.m)	mil 0.30	mil 0.375	mil 0.45	mil 0.50	mil 0.564
Reclamation works (cu.m)	mil 0.06	mil 0.075	mil 0.02	mil 0.025	mil 0.048

7-1-2 Establishment of Construction Cost of Planned Terminal

(1) Quantities of Works of Planned Terminal

7. After the basic design of the proposed facilities at each terminal is prepared, the quantities of works of such designed facilities for the specified size and type of ferry boats at the respective terminals are estimated based on the topographic and hydrographic surveys charts and the soil investigation report.

8. The quantities of works of the planned facilities at each terminal are shown in Table 7-1-1A Construction Cost of Each Facility and Table 7-1-2A Detailed Construction Cost.

(2) The Construction Cost of Planned Facilities

a) Review of the Construction Cost in the Master Plan

9. The construction costs of the basic facilities as prepared for the Master Plan have been are reviewed, since the type and number of the breasting and mooring dolphins the extent of pile length, and the size of each structure have been determined in more detail according to the soil data and sounding charts at each site.

10. The construction costs of dolphins, movable bridge foundation, its protection dolphin, trestle, wharf, movable bridge at the respective terminals vary depending on the type and size of the structures and their foundation and due to the respective field conditions.

These costs are amended according to the scope of works determined by the respective basic design.

b) Construction Cost Estimate of New Items of Work

11. The following new items of work have resulted from the basic design at the respective terminal sites,

- Concrete caisson structures for dolphins at Terong,

- Coral reef dredging works at Mokmer and soft clay removal for the basin and approach channel at Bajoe site,
- Breakwater with steel sheet pile at Muntok and rock mound with armour stones at Mokmer and Saubeba
- Installation of truck scale equipment at Bajoe, Kolaka, Palembang and Muntok

12. The construction costs of the above items are determined by using the same basic construction costs and material costs (as listed in Table 7-1) as applied for the Master Plan with an adjustment factor to cover the cost of the related preparatory works, equipment mobilization and work arrangement at site.

13. The above works resulting from the basic design are the fundamental and major components of the works for the construction of the planned terminals.

14. Their construction costs are estimated in relation to the respective works arrangement and methods as detailed below;

(1) Route 2, Mokmer - Saubeba Terminals

15. The coral reef dredging cost is estimated with the assumption that the dredged materials are used for the causeway construction and reclamation materials for the land formation.

16. The unit cost of the dredging works includes the following items;

- Mobilization of a dredger (clamshell type with 1.0 cu.m bucket capacity) and one dumping hopper barge
- Preparatory works for the reclamation and causeway

17. The cost of breakwater construction at Saubeba terminal is estimated with the assumption that it is constructed by gravel and rock material by the end-on system, the materials being obtained from the mountain behind the planned terminal.

(2) Route 3,Lewoleba - Terong Terminals

18. The dolphin structures and movable bridge foundation are designed as concrete caissons installed on a rubble mound for base protection.

19. The cost of the rubble mound for base protection includes transportation of rubble stone materials, equipment cost of clamshell bucket and hopper barge for dumping.

20. One unit caisson cost for dolphins includes the caisson yard preparatory works at the sandy beach about 2-300 m east from the site and transportation cost, in addition to the caisson fabrication with concrete and sand fill in the cells.

(3) Route 8, Bajoe - Kolaka Terminals

21. The cost of the approach trestle from the existing causeway to the new jetty at both terminals is determined by using the materials cost and basic construction cost (as listed in Table 7-1-1) and the designed volume of works.

22. The cost of truck scale installation on both sites is estimated by including the works of reclamation for land formation, building works for installation of weight measure equipment, and the equipment itself. The scope of the truck scales is based on the existing system at Bajoe terminal and Bakahuni terminal in Sumatera.

23. The dredging cost of soft clay mud material at Bajoe includes the following;

- Mobilization of cutter suction dredger (capacity of pump, 1,000 to 1,500 HP) and discharging floating pipe lines of about 2,000 to 2,500 m length
- Preparatory works for the dumping area of the dredged material by retaining with wooden posts and wall
- Operation cost of dredger

24. The cost of water supply to a 1,000 GRT terminal is estimated to be about 1.5 times that of a 300 GRT terminal. The cost of electric power supply