Table 5-1 Comparison of Annual Cost by Size of Vessels

Gross Tonnage	2,000	1,500	1,000
Ship Acquisition Cost	(¥400,000,000) P 80,000,000	(¥340,000,000) P 68,000,000	(¥250,000,000) P 50,000,000
(Capital Cost)	(P1,000)	(P1,000)	(P1,000)
Repayment	4,000	3,400	2,500
Average Interest	4,200	3,570	2,625
Sub Total	8,200	6,970	5,125
(Operation Expense)			
Bunkering Expense including diesel fuel and lubricants	8,534	8,276	7,994
Other Voyage Expense including insurance, supplies and port charges etc.	2,165	1,963	1,761
Vessels Depreciation on Cost	3,600	3,060	2,250
Crew's Expense	4,004	3,836	3,768
Docking Repair & Maintenance	3,082	2,886	2,691
Miscellaneous	2,606	2,489	2,382
Sub Total	23,991	22,510	20,846
Annual Total Cost	32,191	29,480	25,971
Annual Total Cost per G/T	16.1	19.7	26.0

Note:

Age of Vessel : Assumed as nearly 10 years old
Repayment : Annual average amount for 20 years
Average Interest : Annual average interest with rate of 10% for 20 years
Depreciation on Cost: Annual average amount for 20 years with remaining of 10% of total acquisition cost

Source: JICA Study Team
Figure for calculation are based on data and information from shipping firms concerned

17. According to the forcasted volume of cargo and passenger in the long term stage after 2010, 223,000 metric tons of cargo and 3,853,000 passengers are required to be transported on Iloilo/Bacolod link. The following table shows that how many vessels and berths are needed on the link to meet the required volume of cargo and passenger. The same table also indicates the annual total costs based on calculated factors by size of vessel.

Table 5-2 Annual Total Cost by Size of vessel in 2010

	2,000 grt.	1,500 grt.	1,000 grt.
number of vessel	4	5	5
number of berth	2	3	3
annual total costs (mil.P)	32.2 × 4 = 128.8	29.5 × 5 = 147.5	26.0 × 5 = 130.0

Source: JICA Study Team

18. As can be seen above, in the case of 1,500 grt and 1,000 grt sized vessels, it is necessary to provide five vessels with three berths in both Iloilo and Bacolod ports respectively to serve the route covering the demand for transportation. The same table also shows that their annual total costs are 147.5 mil. Pesos and 130.0 mil. Pesos respectively. In the case of a 2,000 grt sized vessel, it is enough to provide four vessels with two berths both in Iloilo and Bacolod ports amounting the annual total costs to 128.8 mil. Pesos.

19. Obviously, from a viewpoint of the annual total costs for operation, the 2,000 grt size is most favorable among the three alternatives. Furthermore, considering the future condition for operation in the long term stage after 2010, it will be reasonable to select the 2,000 grt size as the most suitable vessel for the link in 1997. Because, in the cases of 1,500 grt and 1,000 grt size vessels they have no flexibility in the capacity to meet the increasing demand of transportation required on the link in the future. It is also important that in the cases of 1,500 grt and 1,000 grt sizes it is necessary to provide one more facility for berth respectively both in Iloilo and Bacolod ports.

B. Required Water Depth and Area

20. The length and water depth of a berth for mooring a A single hull ferry boat can be determined using the Japanese port facility criteria described in "Technical Standard for Port and Harbor Facility of Japan," when the overall length or draft of the boat is not known. The berth length and water depth for a 2,000 grt Ro/Ro vessel are 115 m and 5.5 m respectively.

21. According to "Technical Standards for Port and Harbor Facilities of Japan," the required water area for the turning basin is the area of a circle with a diameter three times grater than the planned vessel length. In the case of a 2,000 GRT Ro/Ro ferry boat, standard overall ship length is 96 m. The width of waterway must be 1.5 times greater than the vessel length in the case of two-way traffic.

C. Possible Site of Ro/Ro Terminal

Port of Iloilo

22. The present land use of Iloilo city is mapped in Figure 5-1. It shows that the commercial area is behind the River Port and Old Foreign Pier and the residential area is situated at the back of the commercial area. Land uses for agricultural and farming are found behind International Commercial Port Complex (ICPC). According to the Planning Authority of the city, the industrial zone which consists of the heavy and light industrial area is planned to be developed adjacent to the ICPC. The present situation of land use around the port are shown in Photo 5-1, 5-2 and 5-3.

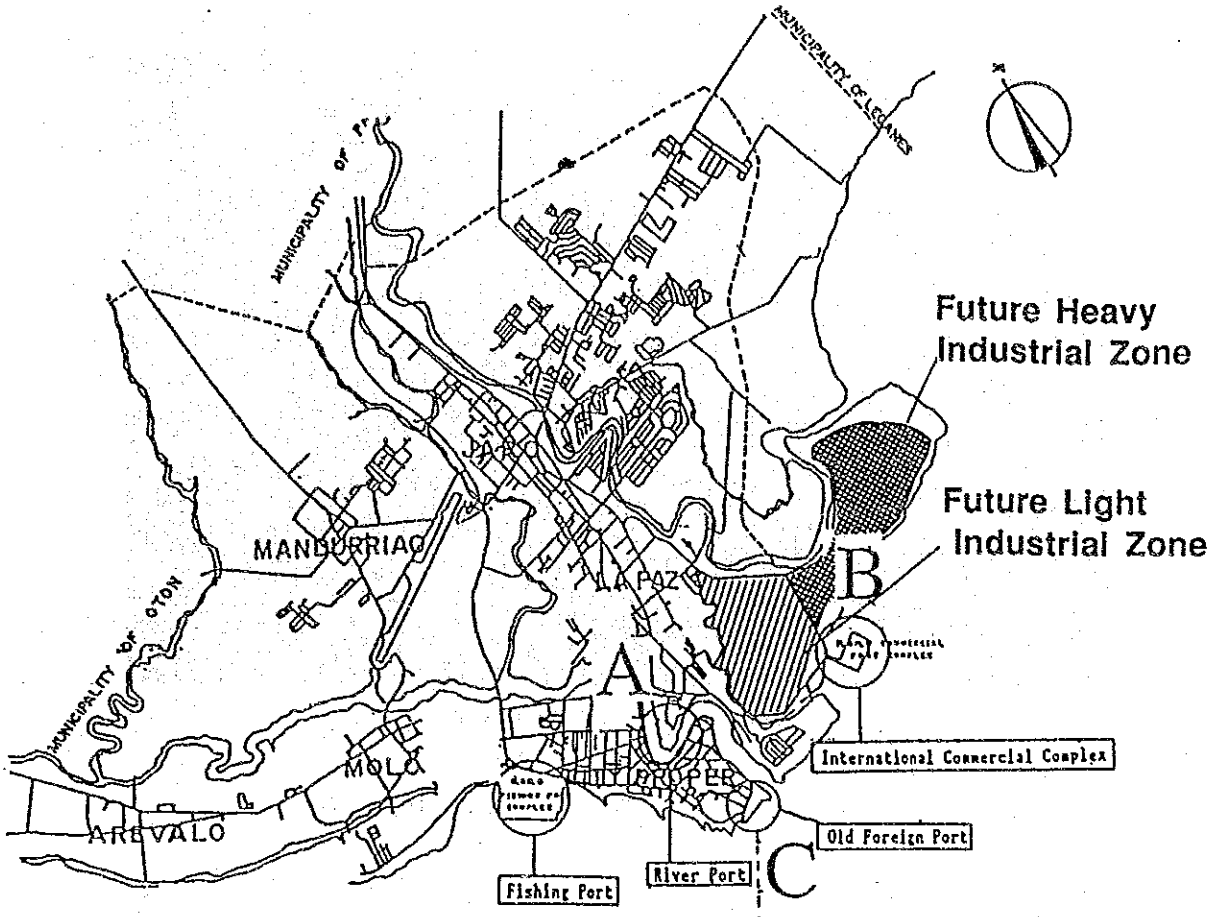


Figure 5-1 Present Land Use in Iloilo City

Source: JICA Study Team

Photo 5-1 Port of Iloilo
(River Port)
Source: JICA Study Team

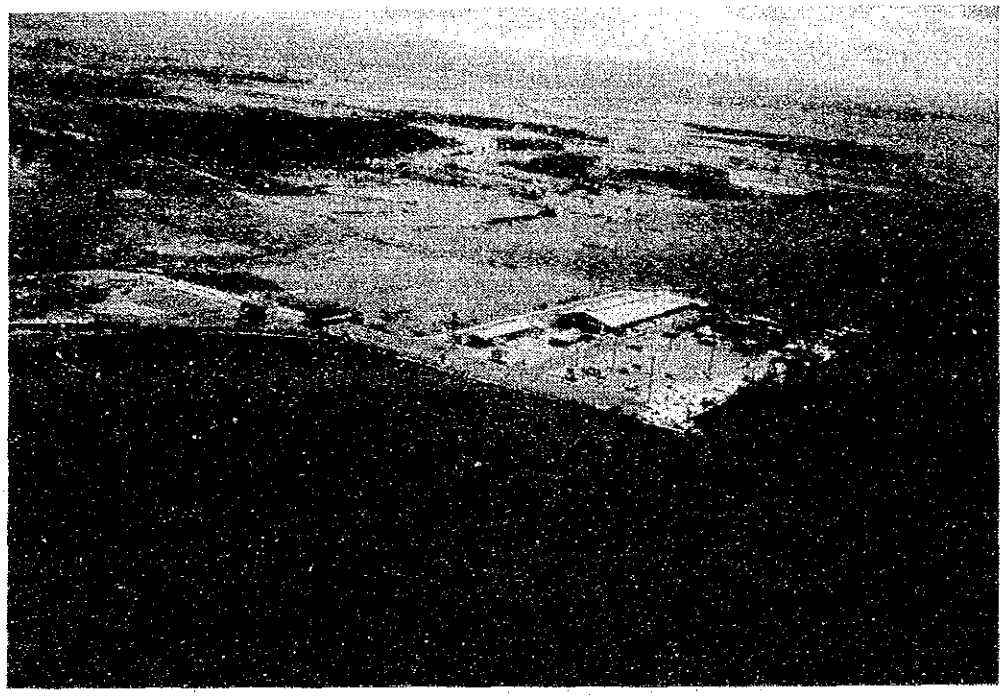


Photo 5-2 Port of Iloilo
(International Commercial Complex)
Source: JICA Study Team

Photo 5-3 Port of Iloilo
(Old Foreign Pier)
Source: JICA Study Team

23. Present road network extends from Iloilo city center to the hinterland as shown in Figure 5-2. From this figure, it can be seen that there is good access from Old Foreign Pier and River Port to the trunk highway which runs to the inner part of Panay Island. Further it should be mentioned that the two ports are located in the proximity of the city center. As for the ICPC, access to the city center is limited to only one road which connects to the trunk highway. A passenger path to the city center does not exist.

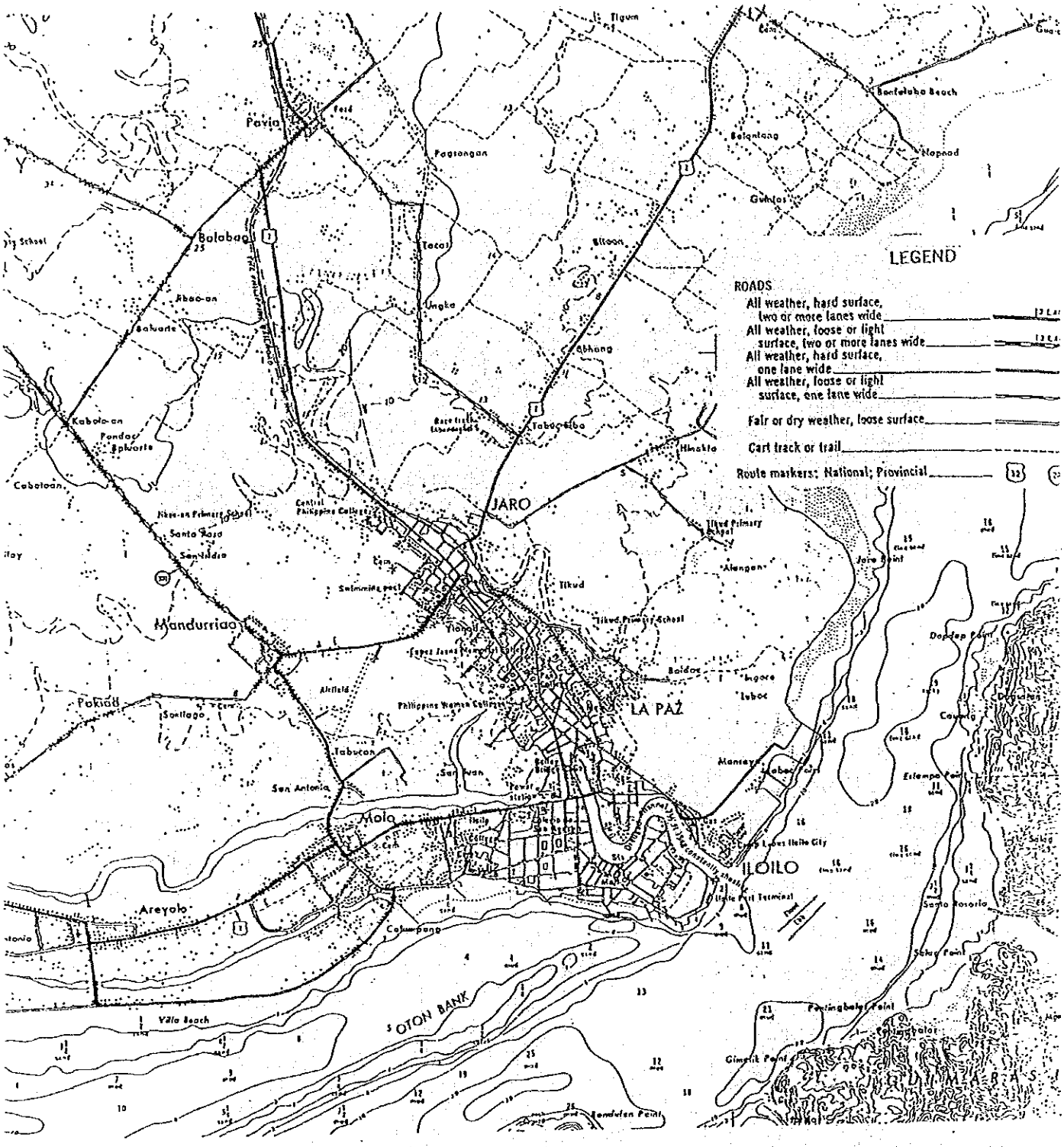


Figure 5-2 Road Network to the Hinterland of Port of Iloilo

Source: NAMRIA, November 1988.

24. Present states of utilization of three terminals in Iloilo Port, namely River Port, ICPC and Old Foreign Pier, are analyzed using data of PPA monthly report May 1990. Berth occupancy ratio and berth productivity are shown in Table 5-3.

Table 5-3 Existing Berth Condition of Port of Iloilo

Item	River Port	I.C.P.C	Old Foreign Pier
Berth Occupancy Ratio (%)	98	30.6	40.9
Cargo Volume Handled per meter per month (MT)	35	133	46

Source: JICA Study Team based on the PPA Monthly Report, May 1990

25. The River Port is situated near the city center and is used by small cargo vessels or barge vessels. However, this port has a limited expansion area and the width of the apron is only 20 m and water depth is limited to 3.0 m. The existing berth is fully utilized. The future cargo volume is forecasted to increase in line with the improvement of living standards in this region. And the berth will be more over utilized. Thus, the increased portion of cargo will be shifted to other terminals such as the Old Foreign Pier.

26. ICPC was constructed to accommodate ocean going vessels and Ro/Ro container vessels for Manila-Iloilo link. A general port layout can be seen in Figure 5-3. This terminal has a sufficient water depth and a wide container yard. However, it is located 1.5 km to the north of the city center.

The berth occupancy ratio is not high at present. However, it is expected that the container cargo as well as break bulk cargo will increase in volume. This terminal will work together the industrial zone behind it and is also expected to play a role as the trade center within Region VI to promote international trade.

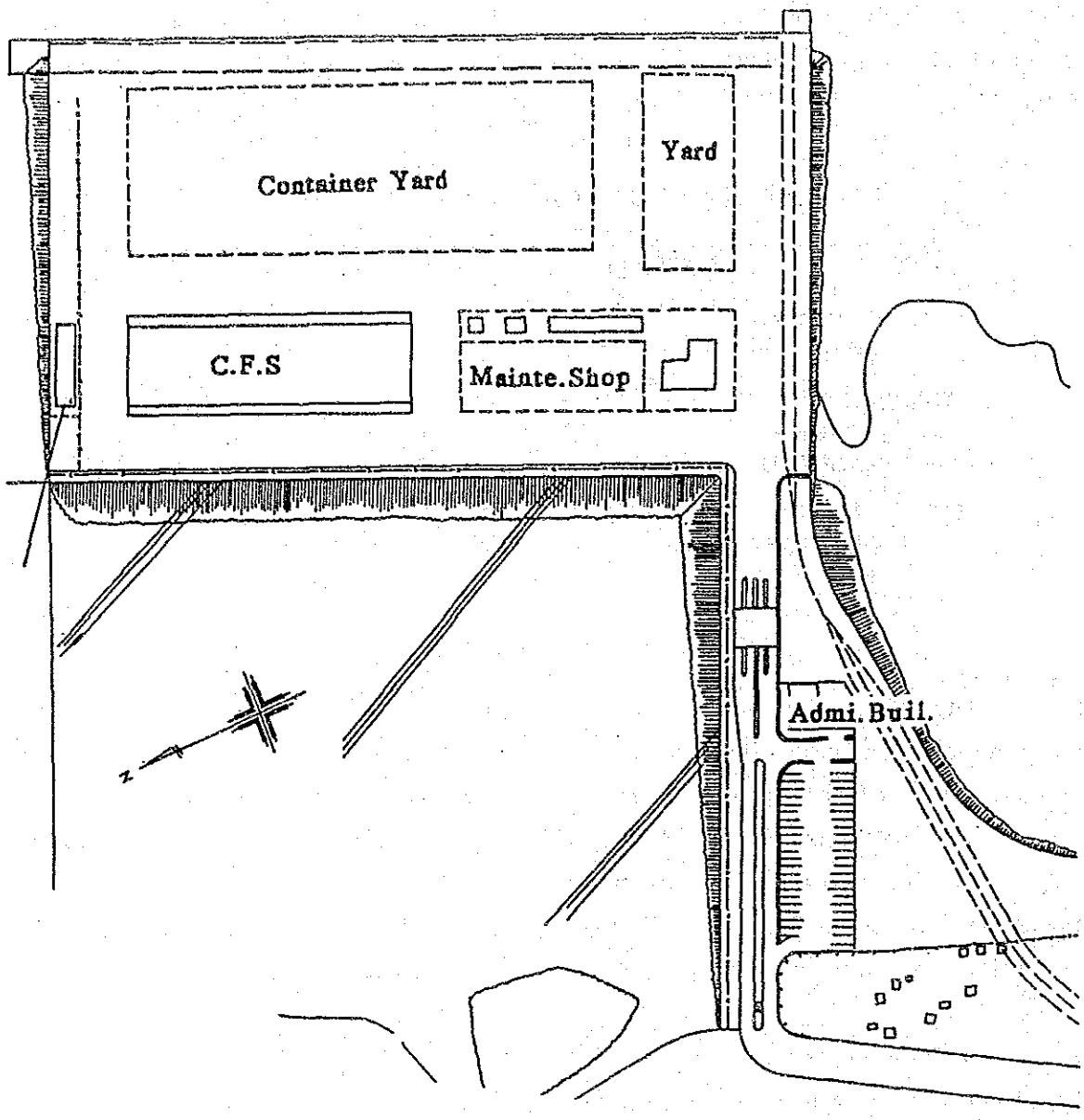


Figure 5-3 Layout of ICPC
Source: PMO Iloilo

27. Old Foreign Pier is situated in the proximity of the city center. Passenger/Ro/Ro vessels which are plying between major cities in the Philippines call this terminal. It is very convenient for passengers since they can change vessels at one terminal and then go to their destinations.

The berth occupancy ratio of this pier is estimated to be about 40 percent. However, this figure does not necessarily mean that this pier is operated at a low efficency.

28. As for the natural conditions of the Iloilo ports, Old Foreign Pier and ICPC open to the sea. The water depth at 20 m south of the existing Old Foreign Pier is sufficient to accommodate a future Ro/Ro vessel. The current is fast and the problem of siltation does not exist. The wave conditions are favorable because the Iloilo-Bacolod ferry operates almost every day of the year. As for Old Foreign Pier, it has a sufficient water area for a turning basin or waterway. The bearing stratum is 20 m below the present sea bed. The clay for settlement is not present. A summary of the natural condition at the Old Foreign Pier is shown in Table 5-4.

Table 5-4 Summary of the Natural Conditions of the Port of Iloilo

Item	Natural Condition (at Old Foreign Pier)	
Wind	Oct-May NE 3 - 6 m/sec	
	Jun-Spe SW 3 - 4 m/sec	
	Average N 4 m/sec	
Tide	M.H.H.W	1.57 m
	M.H.W	1.30 m
	M.S.L	0.75 m
	M.L.W	0.21 m
	M.L.L.W	0.00 m
Current	1.0 m/sec - 2.0 m/sec	
Design Wave	H (1/3) = 1.5 m	
	T (1/3) = 3.4 sec	
Calmness (H < 0.5m)	99.8%	
Geological Con.	0 m - -25 m	Silty Sand
	-25 m -	Silty Sand
Siltation	No	

Source: JICA Study Team

29. Table 5-5 summarizes the existing conditions of the three(3) terminals in Iloilo Port.

Table 5-5 Comparison of the Site Conditions in Port of Iloilo

Item	River Port	Old Foreign Pier	ICPC
Site Location	Close to the City	Close to the City	Distant from the City
Existing Port Utilization	For Small Vessel Port	Ferry Terminal & General Cargo	International & Container Cargo
Calling Ships	Domestic	Domestic	Foreign & Domestic
Possible Expansion Area	Non	Existing	Existing
Berth Condition	Damaged	Good	Good
Water Depth	3.0 m	6.0 m	10.0 m
Transport from/to City	Not Necessary	Not Necessary	Car
Owner/Operator	PPA	PPA	PPA

Source: JICA Study Team

30. Old Foreign Pier is considered to be only the appropriate site for the Ro/Ro terminal for the following reasons;

(i) Other two terminals are either already over utilized or in near future become overloaded.

(ii) Connection to other ferry links is better than other sites.

(iii) Since almost all passengers on board the Iloilo-Bacolod ferry originated in or are destinated for Iloilo city, it is desirable that the location of Ro/Ro ferry terminal be close to the city center.

31. According to the regional development plan of NEDA, Iloilo city is considered to be the economic/trade center of the region. The port of Iloilo may carry out the role of international trade port, fish & fish preparation export port, cargo port and passenger/vehicle ferry port. As the growth of the regional G.D.P increases, the cargo/passenger volume is expected to increase, and thus the future roles of terminal port should be clearly delineated. The suggested future function of each terminal is as follows;

Old Foreign Pier	- to serve as the ferry/Ro/Ro function. - the berth is used exclusively for ferry. - time schedule plan is essential.
ICPC	- for long distance Ro/Ro vessels, ocean going vessel and large bulk/container vessel. - the berth is also used for tramper. - efficient cargo handling is required.
River Port	- for small cargo vessel use. - the exclusive berth use may be required for each shipper/consignee.

Port of Bacolod

32. Proposed future land use of Bacolod city is mapped in Figure 5-4, which shows that the commercial area is situated at the center of the city and the government/public/green zone is situated near the commercial area. While the residential area is located at the outskirts of the above two(2) areas, agricultural land and cultivated farms are situated at the outer area of the city. The existing situations around two terminals are shown photographically in Photo 5-4 and 5-5.

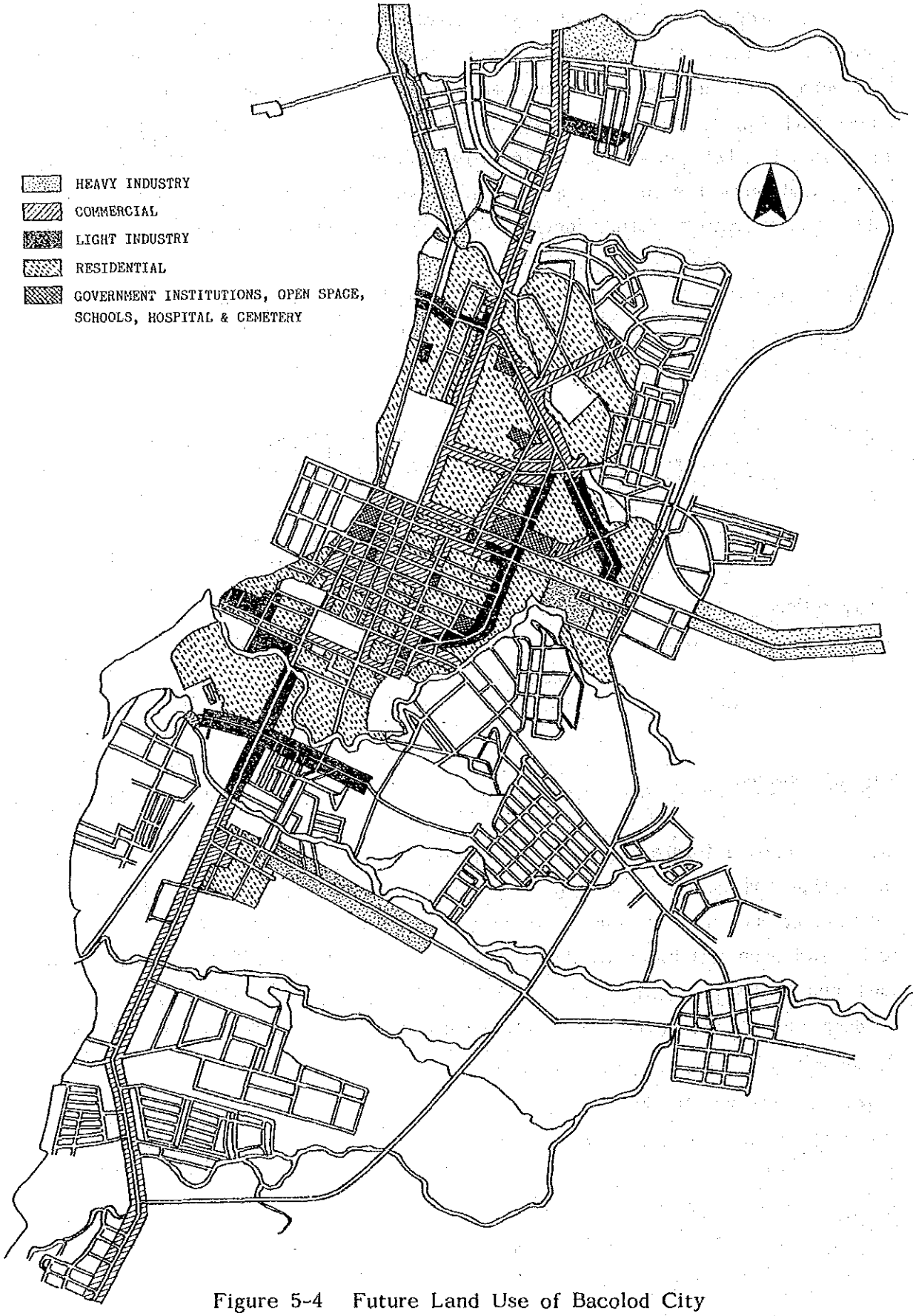


Figure 5-4 Future Land Use of Bacolod City
Source: Bacolod City

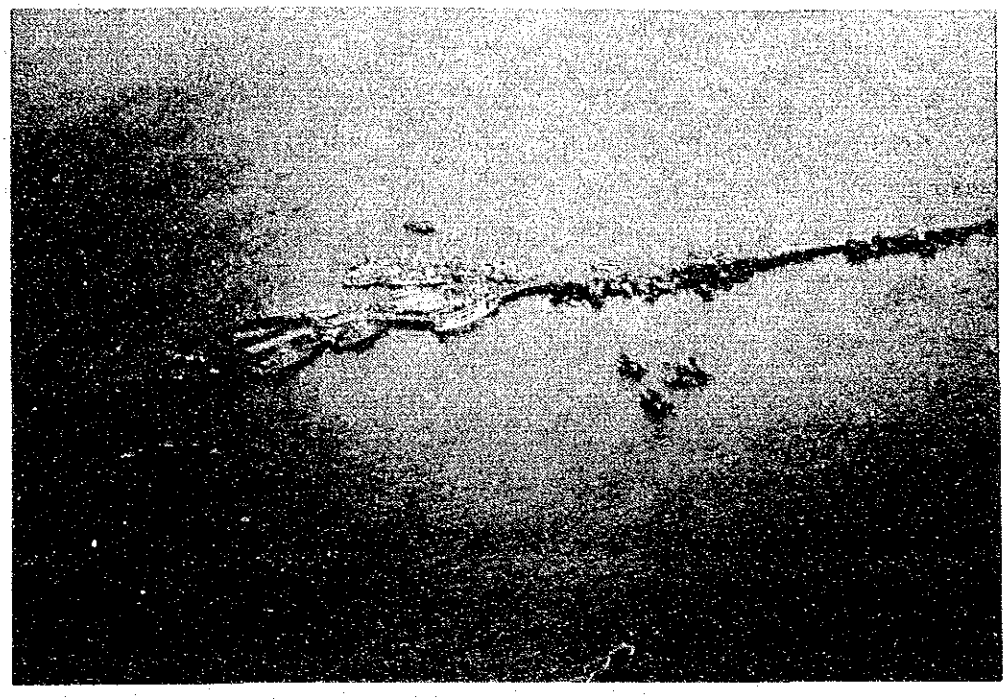


Photo 5-4 Port of Bacolod
(Banago Pier)
Source: JICA Study Team

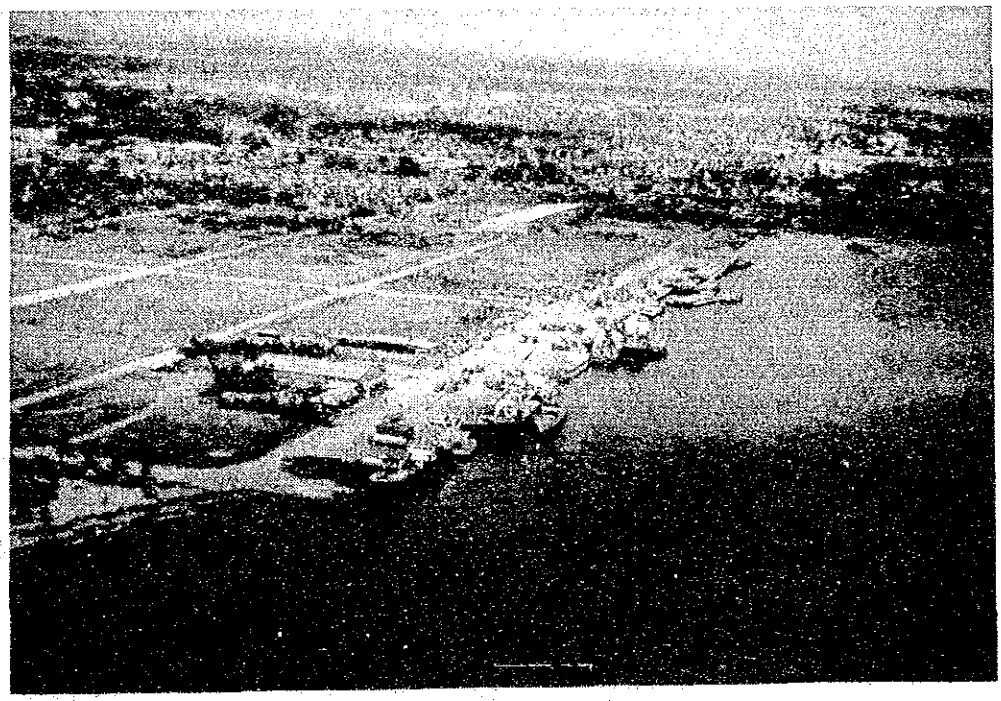


Photo 5-5 Port of Bacolod
(Reclamation Area)
Source: JICA Study Team

33. Present road network centered at Bacolod city proper is shown in Figure 5-5. The trunk highway runs through Bacolod city to the inner part of Negross Occidental. The access road from the main two(2) terminals (Banago Pier and Reclamation Area) is connected efficiently to the trunk highway. The pavements of the trunk highway and access roads are in good condition. The city center is a short distance from the Reclamation Area and 3 km south from Banago Pier.

34. The present states of utilization of the two ports in Bacolod city, i.e., Banago Pier and Reclamation Area, are analyzed using data from PPA monthly report May 1990. Berth occupancy ratio and berth productivity are shown in Table 5-6.

Table 5-6 Berth Occupany Ratio of Port of Bacolod

Item	Banago Pier	Reclamation Area
Berth Occupancy Ratio (%)	73	211
Cargo Volume Handled per meter	(22,444 MT/ berth/month)	140 MT

Source: PPA Monthly Report May, 1990

35. Banago Pier is owned by the Negros Navigation Co. Inc., and is the present ferry terminal from/to the Port of Iloilo. This port has other functions such as general cargo port and fishing port for small fishing vessels. This pier has a maximum water depth of five meters, and large vessels regularly call this Pier. However, the terminal area is limited, measuring only 3,400 m^2. The berth occupancy ratio at present is a rather high at 73%. Some of the wharf facilities are already superannuated and cannot support heavy surcharge.

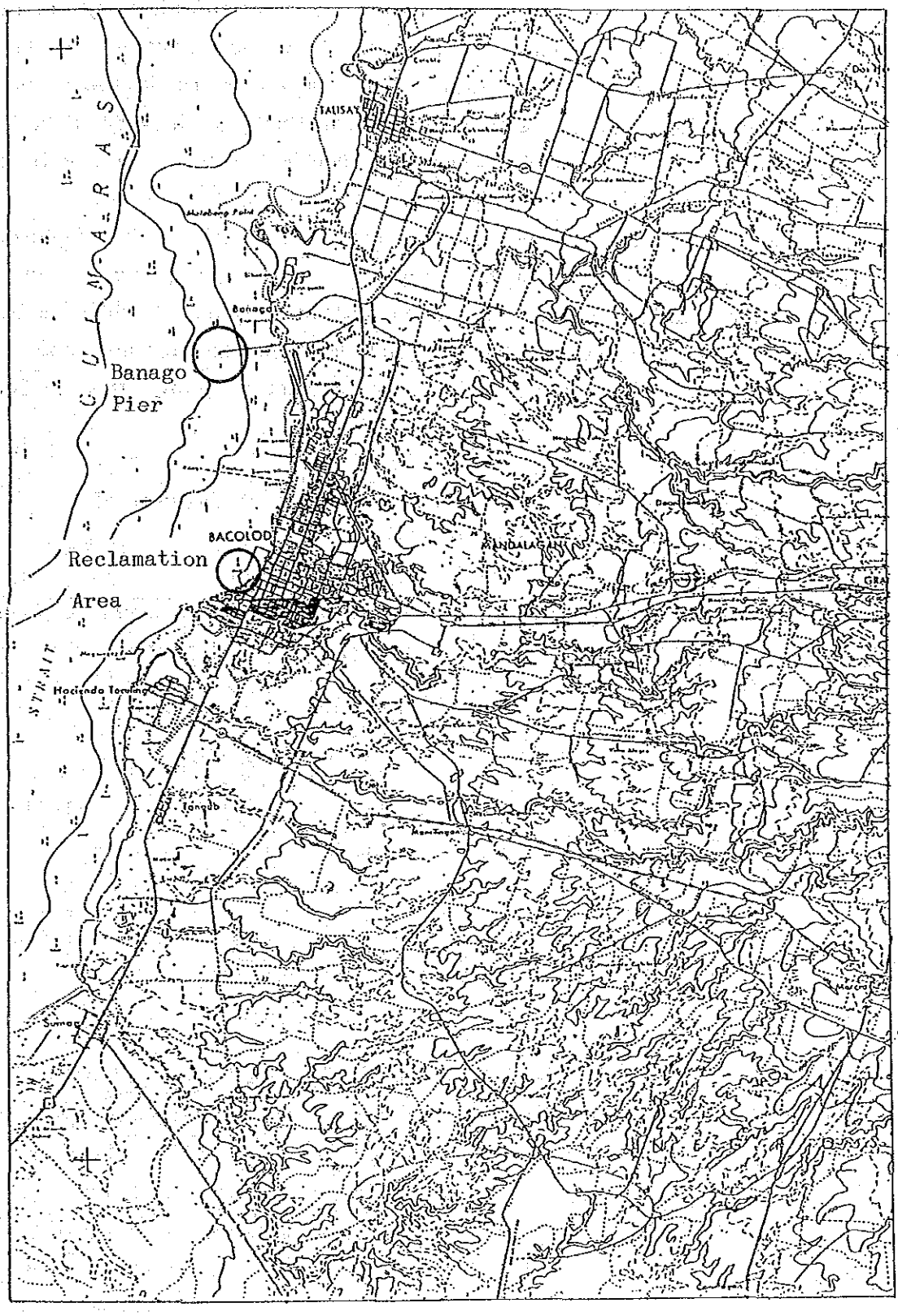


Figure 5-5 Present Road Network in Bacolod City

Source: NAMRIA, November 1988.

36. The Port of Reclamation Area is situated in front of the city center. The water depth is limited to only two meters. This port handles both bulky cargoes and general cargoes. With respect to passenger traffic the reported number is negligible. Present berth utilization of this port is very high. The berth occupancy ratio is 211 %, which indicates double berthing at one time.

37. Natural conditions in Bacolod are summarized in Table 5-7. According to the information obtained through interviews, the existing ferry operates every day of the year except for days when a typhoon is approaching. Subsoil condition survey reveals that sea bed materials near Banago Pier are good for construction. The bearing stratum can be found ten meter below the sea bed.

Table 5-7 Summary of the Natural Conditions of the Port of Banago & Reclamation Area

Item	Natural Condition (at Banago)	Natural Condition (at Reclamation Area)
Wind	Oct-May N 4 - 5 m/sec Jun-Sep S 4 - 5 m/sec Average N 4 m/sec	Oct-May N 4 - 5 m/sec Jun-Sep S 4 - 5 m/sec Average N 4 m/sec
Tide	M.H.H.W 2.05 m M.H.W 1.76 m M.S.L 1.01 m M.L.W 0.26 m M.L.L.W 0.00 m	M.H.H.W 2.05 m M.H.W 1.76 m M.S.L 1.01 m M.L.W 0.26 m M.L.L.W 0.00 m
Current		
Design Wave	H (1/3) = 2.3 m T (1/3) = 6.2 sec	H (1/3) = 2.3 m T (1/3) = 6.2 sec
Calmness (H < 0.5m)	97.8%	97.8%
Geological Con.	0 m - -2 m Sand -2 m - -4 m Clay -4 m - -13 m Sandy Silt -13 m - Silty Sand	0 m - -5 m Silty Sand -5 m - -10 m Silty Clay -10 m - Silty Clay
Siltation	-6.0 m ---- Existing	-3.0 m ---- Heavy -6.0 m --- Existing

Source: JICA Study Team

38. As for the Reclamation Area, the wave condition is the same as for Banago. The sea bed material is good for construction. Water depth abruptly increases 1,500 m away from the seashore line. Inside this area, the water depth varies between -3.0 m and -0.0 m, consequently siltation problem exists.

39. Table 5-8 summarizes the existing conditions of the two port in Bacolod City.

Table 5-8 Existing Site Conditions of Banago and Reclamation Area

Item	Banago Jetty	Reclamation Area
Site Location	Distant from the City	Close to the City
Port Area	Insufficient for Future Ro/Ro	Insufficient for Future Ro/Ro
Existing Port Utilization	Passenger Ferry & Fishing Vessel	Bulk Cargo & General Cargo
Calling Ships	Domestic	Domestic
Possible Expansion Area	Non	Existing
Berth Condition	Superannuated	Good
Water Depth	4.5 m	1.5 m
Transport System from/to City	Car	Not necessary
Owner	Negross Nav. Co,.Inc.	Bcolod Reclamation and Development Co,.Inc.

Source: JICA Study Team

40. While the Banago will continue to function as a port for passenger and cargo vessels and small fishing vessels, the port of Reclamation Area will function mainly as a cargo handling port. Even if the Ro/Ro terminal is constructed in either of these ports, these functions will be preserved for the convenience of seaborne trade. With this in mind, the development policy for these ports entails the construction of a new Ro/Ro terminal in addition to the above functions.

41. Since no available area for Ro/Ro transport exists in or adjacent to any of existing terminals, the following three(3) alternatives shown in Figure 5-5 will be examined and evaluated as a Ro/Ro terminal site.

Alternative A; Expansion of Banago Pier
Alternative B; New pier construction from Reclamation Area
Alternative C; New pier construction from existing shoreline

42. Alternative A is to extend the existing jetty up to the place where necessary water depth can be obtained. This alternative has the advantage of being able to use the existing rock causeway and other facilities.

43. Alternative B is to construct a new jetty from the Reclamation Area. This alternative has the advantage of being close to the center of Bacolod City. The Reclamation Area also has a spacious land for future development.

44. Alternative C is to construct a new jetty from the natural shoreline. The site is selected in front of the Government/Public/Green zone shown in Figure 5-6. This alternative would eliminate the problem vested interests on the part of private companies because it is a new site.

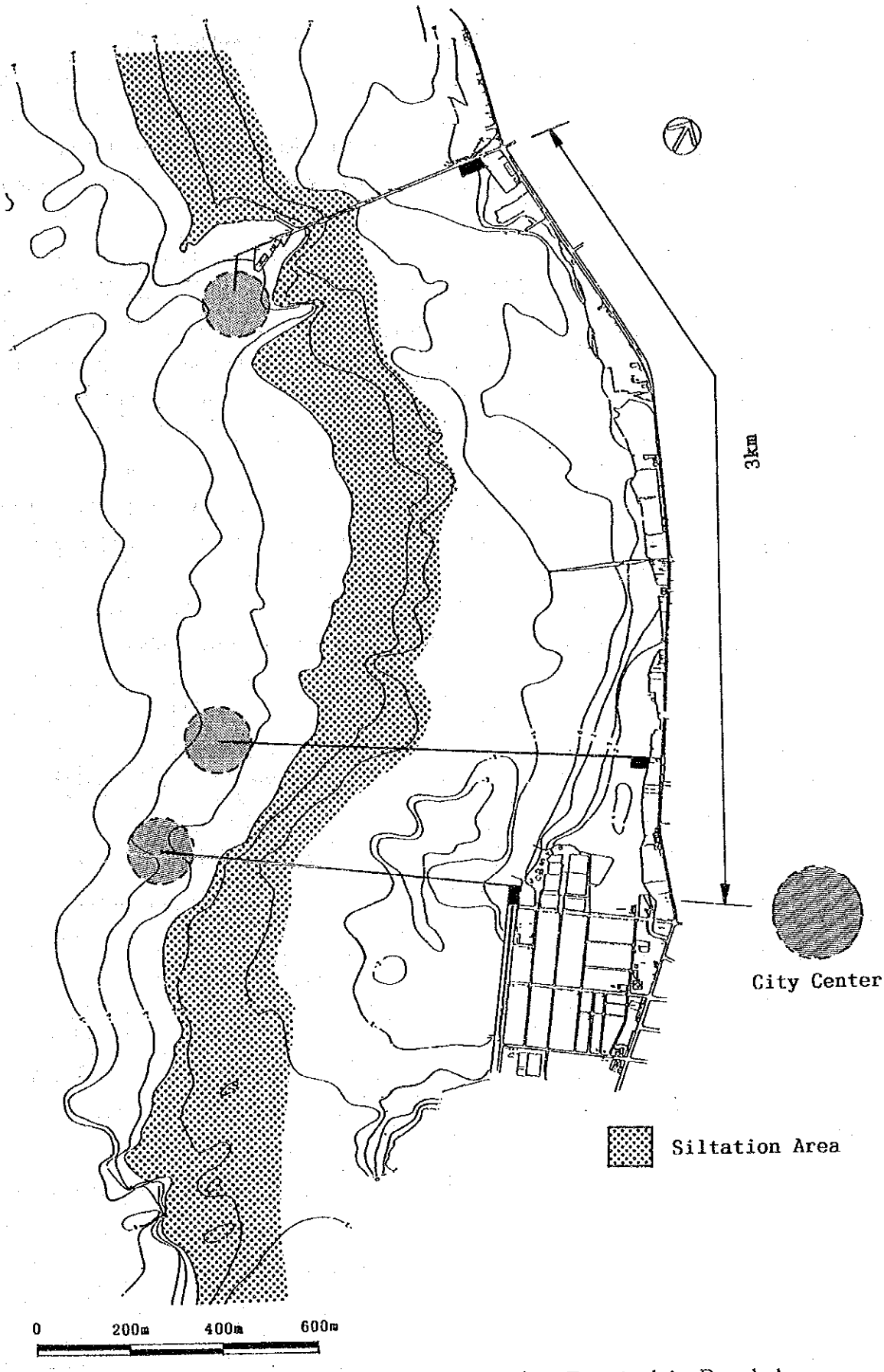


Figure 5-6 Alternative Sites for Ro/Ro Terminal in Bacolod

Source: JICA Study Team

D. Difference of Construction and Transportation Cost among Alternatives at Port of Bacolod

45. A preliminary calculation on construction cost and transportation cost for each alternative site was carried out to look into the cost difference among them.

46. A calculation of construction costs of the facilities at the three alternative sites was conducted for one design of each site. Of course, the design should have some alternatives, however, difference in the construction cost is negligible, keeping in mind the huge total cost. And, needless to say, maintenance cost is almost equal for each site.

47. Many benefit are envisaged regardless of where the site may be. However, the transport cost from city to pier marks the difference among the three alternatives. The cost differences are shown in Table 5-9.

Table 5-9 Construction Cost Difference among Alter natives

Unit: million peso

Item	Alternative A	Alternative B	Alternative C
Construction Cost of New Terminal	185	283	351
Existing Berth Value	0.7	-	-
Expence for Existing Causeway	5	-	-
(Total)	189	283	351
Difference	-	94	162

Source: JICA Study Team

48. Construction cost difference between Alternative A and Alternative B amounts to 94 million pesos, and that between the alternative A and the Alternative C amounts to 162 million pesos in favor of the former.

The annual land transportation cost at alternative A is 4.46 million pesos higher than that of the others.

49. The comparison of the combined cost (construction cost and transportation cost) shows that Alternative A has a 60.8 million pesos advantage over Alternative B, providing that the discount cash flow rate is 15 % and that the project life is 25 years (Table 5-11).

50. Other factors which may be taken into consideration for site selection are briefly summarized in Table 5-10.

Table 5-10 Comparision of Other Issues for Site Selection

(Item)	(Banago Pier) Alternative A	(Reclamation Area) Alternative B	(New Area) Alternative C
1. Influence on the manleuvering and cargo handling during the construction work	Nil	Nil	Nil
2. Siltation	Nil	Construction of new causeway may generate siltation	Same as Reclamaction Area
3. Parking area	Can be constructed along the shore line	Same as Alt. A	Same as Alt. A
4. Development effect	Medium	Great	Medium
5. Investment resource	The possibility of investment from private sector	Not possible	Not possible

Source: JICA Study Team

51. According to the above consideration, it is concluded that Alternative A is economically more advantageous than the other alternatives.

Table 5-11 Comparison of Combined Cost

r(%) = 15

Unit : Million Pesos

Year	Construction Cost Difference A - B (a)	Construction Cost Difference of A - C (b)	Transportation Cost Difference A - B (c)	Transportation Cost Difference A - C (d)	Present Value of (a) (o)	Present Value of (b) (p)	Present Value of (c) (q)	(o) + (q) (c)	(p) + (q) (d)	Advantage of Alt.A over Alt.B	Advantage of Alt.A over Alt.C
1	94	162	-4.46	-4.46	94	162	-4.5	89.5	157.5	89.5	157.5
2			-4.46	-4.46	0	0	-3.9	-3.9	-3.9	85.7	153.7
3			-4.46	-4.46	0	0	-3.4	-3.4	-3.4	82.3	150.3
4			-4.46	-4.46	0	0	-2.9	-2.9	-2.9	79.4	147.4
5			-4.46	-4.46	0	0	-2.6	-2.6	-2.6	76.8	144.8
6			-4.46	-4.46	0	0	-2.2	-2.2	-2.2	74.6	142.6
7			-4.46	-4.46	0	0	-1.9	-1.9	-1.9	72.7	140.7
8			-4.46	-4.46	0	0	-1.7	-1.7	-1.7	71.0	139.0
9			-4.46	-4.46	0	0	-1.5	-1.5	-1.5	69.5	137.5
10			-4.46	-4.46	0	0	-1.3	-1.3	-1.3	68.3	136.3
11			-4.46	-4.46	0	0	-1.1	-1.1	-1.1	67.2	135.2
12			-4.46	-4.46	0	0	-1.0	-1.0	-1.0	66.2	134.2
13			-4.46	-4.46	0	0	-0.8	-0.8	-0.8	65.4	133.4
14			-4.46	-4.46	0	0	-0.7	-0.7	-0.7	64.6	132.6
15			-4.46	-4.46	0	0	-0.6	-0.6	-0.6	64.0	132.0
16			-4.46	-4.46	0	0	-0.5	-0.5	-0.5	63.5	131.5
17			-4.46	-4.46	0	0	-0.5	-0.5	-0.5	63.0	131.0
18			-4.46	-4.46	0	0	-0.4	-0.4	-0.4	62.6	130.6
19			-4.46	-4.46	0	0	-0.4	-0.4	-0.4	62.2	130.2
20			-4.46	-4.46	0	0	-0.3	-0.3	-0.3	61.9	129.9
21			-4.46	-4.46	0	0	-0.3	-0.3	-0.3	61.6	129.6
22			-4.46	-4.46	0	0	-0.2	-0.2	-0.2	61.4	129.4
23			-4.46	-4.46	0	0	-0.2	-0.2	-0.2	61.2	129.2
24			-4.46	-4.46	0	0	-0.2	-0.2	-0.2	61.0	129.0
25			-4.46	-4.46	0	0	-0.2	-0.2	-0.2	60.8	128.8

Note : Present Value = Translated value of cost/benefit at objective year using the discount cash flow method
Alt. = Alternative
Source : JICA Study Team

[References]

1. Implementation program for feeder ferry development project, DPWH, January 1986

2. Medium-term public investment program 1988 - 1992, NEDA

3. Updating of the ferry study under the road feasibility studies 3, DPWH, June 1987

4. Nationwide Roll-on Roll-off transport development study, Commodity flow analysis, June 1990

5. Feeder ports study, Asian Development Bank, October 1989

6. Review of transport projects in the MTPIP, 1987 - 1992, NEDA, DOTC, DPWH, PNR, PPA, MARINA, January 1988

7. Regional Physical Framework Plan 1990 - 2020, NEDA

Chapter 6 Long Term Ro/Ro Terminal Plan

A. Planning Condition

1. Long term Ro/Ro terminal plan for the year 2010 is prepared to ensure compatibility with the Nationwide Long Term Ro/Ro Transport Development Plan in Volume I, and to provide the basis of the terminal plan for the year 1997.

2. Iloilo/Bacolod link is an important part of the national transport network. It connects the centers of Panay island and Negros Occidental and consequently enhances the unity of Region VI. Having this in mind, the long term Ro/Ro terminal plan is prepared based on the following suppositions.

(i) Improvement of road and pavement will proceed in line with the national development plan. However, the road network is considered to remain in its present state as shown in Figure 6-1.

(ii) Vessel dimensions are assumed as 2,000 grt. and 96m length passenger/cargo ferry with two ramp ways in her bow and stern; a passenger may board or disembark by using the side gang way.

(iii) Required facilities are berth, Ro/Ro ramp and passenger terminal.

3. Since Iloilo is the center of Region VI, several ferry links are connected at Iloilo port. The passengers switch links here on way to their final destination (see Figure 6-2,6-3).

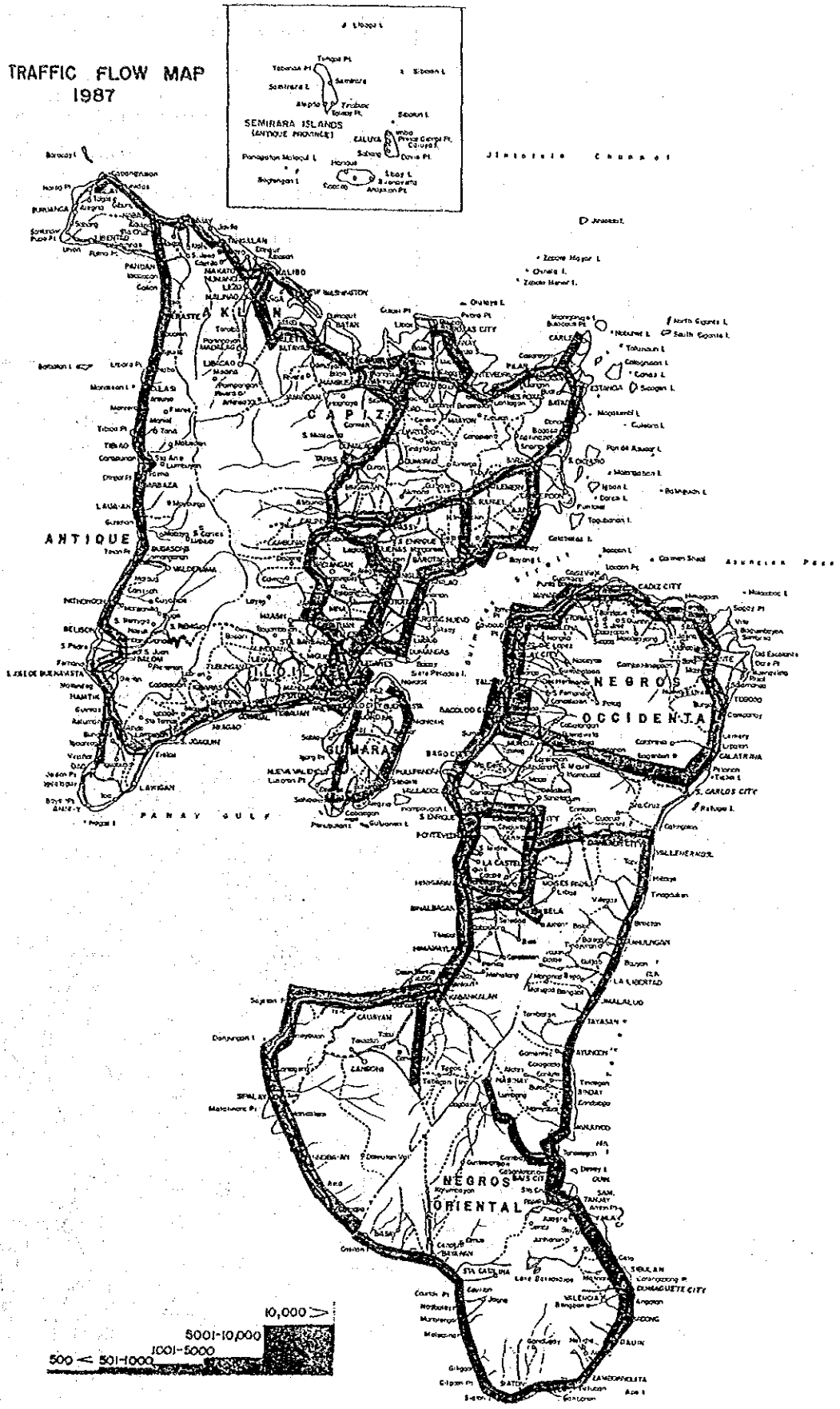


Figure 6-1 Existing Road Connection and Traffic FLow in Region 6

Source: MPWH Infrastructure Atlas

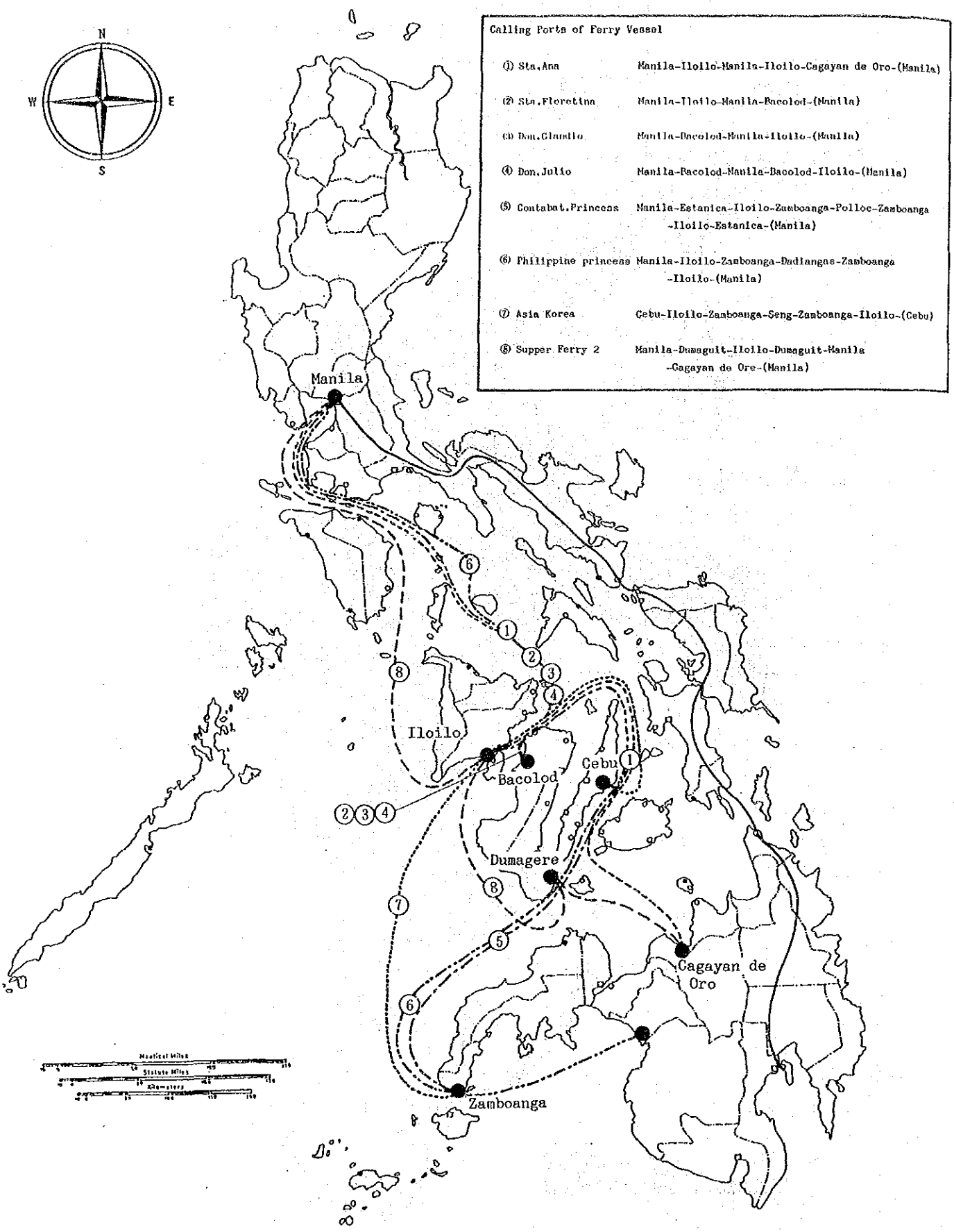


Figure 6-2 Trunk Ferry Routes Connected to the Port of Iloilo.

Source: JICA Study Team

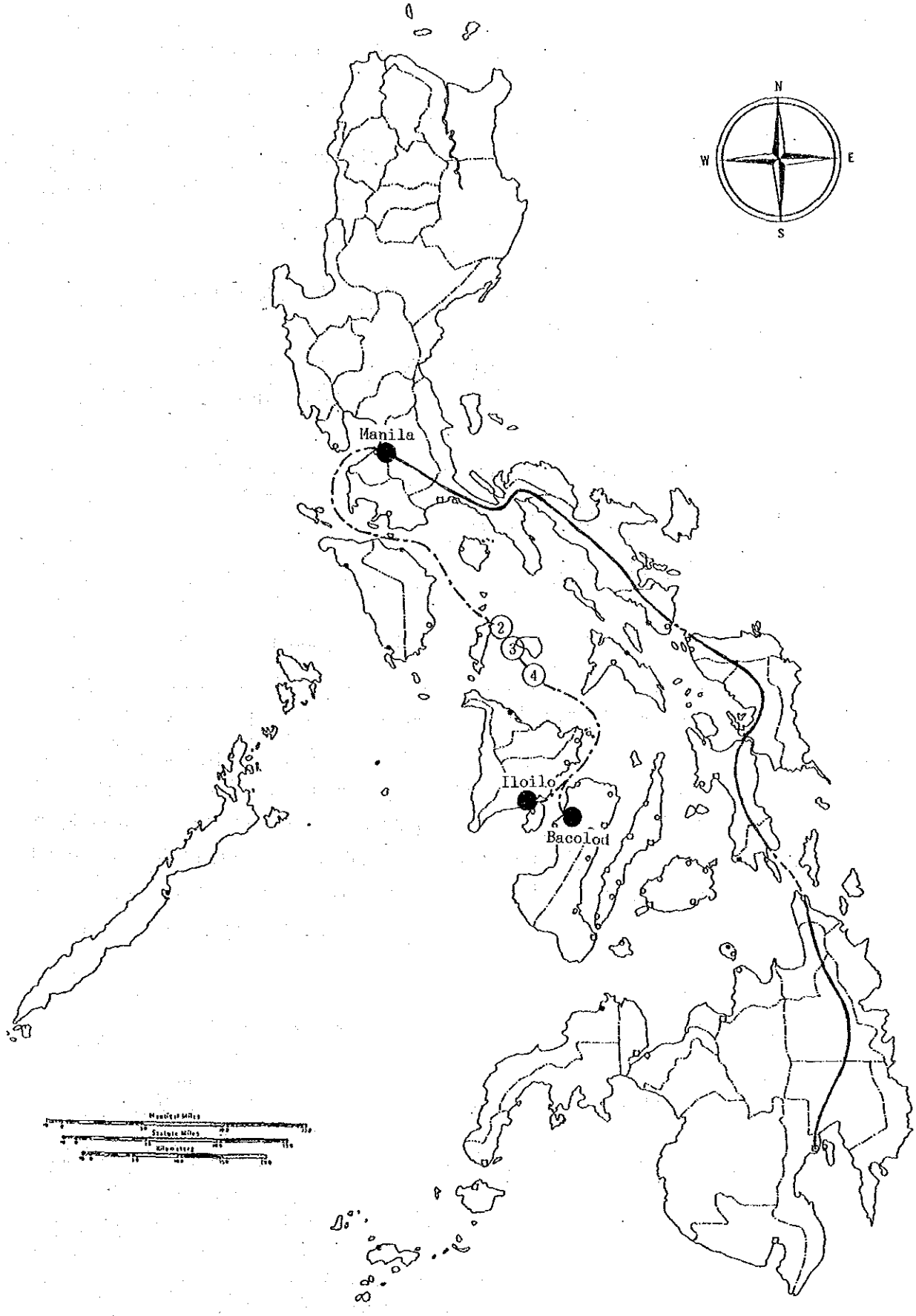


Figure 6-3 Trunk Ferry Routes Connected to the Port of Bacolod

Source: JICA Study Team

Table 6-1 Connection to the Existing Ferry Route at Port of Iloilo

Route Name	Service Vessel
Manila-Iloilo-Cagayan de Oro	Sta.Ana
Manila-Iloilo-Manila-Bacolod	Sta.Florentina
Manila-Estancia-Iloilo-Zamboanga-Polloc	Don Claudio Don Julio
Manila-Iloilo-Zamboanga-Dadiangan	Cotabato. Princesa
Cebu-Iloilo-Zamboanga-Seng	Asia Koria
Manila-Dumaguit-Iloilo-Cagayan de Oro	Super Ferry 2

Source : MARINA 1990

4. Chapter 5, Volume II gave an explanation of the type of vessels assumed to be sailed on Iloilo/Bacolod link. The detailed assumption on vessel capacity and composition of loaded vehicles are shown in Table 6-2.

Table 6-2 Assumed Vessel Capacity and its Loaded Vehicles

Vessel Condition	Passenger Capacity	1,000 pass.
	8 t Truck Loading Capacity	29 car
	Load Factor	65%
	Cargo Capacity Capacity	79.3 ton
Assumed Composition	Bus = 6 Priv.Car = 16 Truck = 9 Jeepney = 25	

Source : JICA Study Team

5. In order to meet the demand of the link in the year 2010, Ro/Ro vessels of the assumed type should make 6 round trips (12 trips.). Projected sailing schedule is that the first two vessels leave Iloilo and Bacolod simultaneously at 5:00 each making six tris a day, and the second two vessels leave each port at 6:30 making also six trips. Accordingly, two berths of each port are required for four vessels. Table 6-3 shows the demand and capacity of the Ro/Ro link in the year 2010.

Table 6-3 Demand and Capacity in the year 2010

Item	Demand	Capacity
Passenger (Person)	3,852,976	4,808,000
Ro/Ro Cargo (M ton)	223,000	323,000

Source : JICA Study Team

6. Ro/Ro vessel operation plan of the link is indicated in the diagrams shown in Figure 6-4. In this operation plan, two 2,000 grt. vessels leave the port of Iloilo and Bacolod simultaneously at 05:00 and make six trips a day.

7. In this sailing plan, four Ro/Ro vessels can carry 323,000 MT of cargoes and 4,808,000 of passenger annually, which meets the required volume of cargoes and passengers on the route in 2010 respectively.

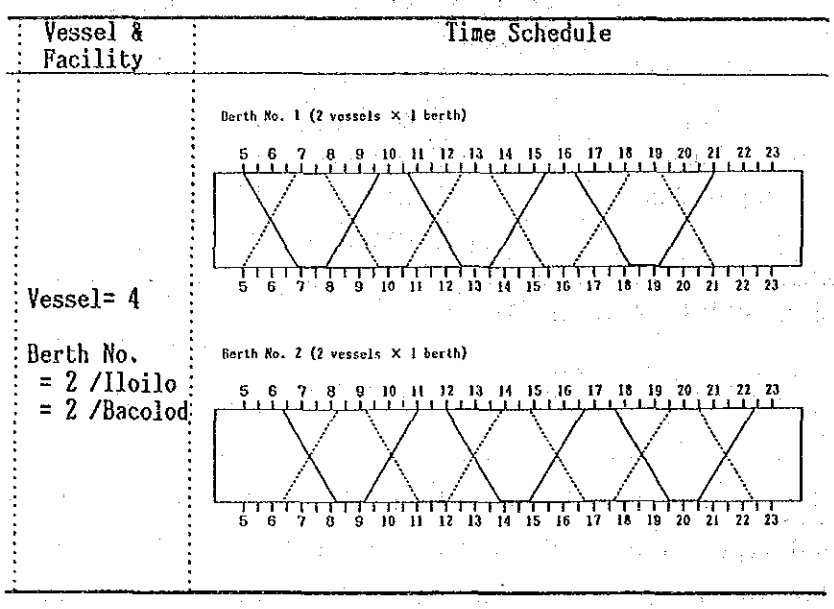


Figure 6-4 Vessel Operation Plan
Source: JICA Study Team

B. Layout Plan of Port of Iloilo (Alternatives and Evaluation)

Existing Berth Utilization of Old Foreign Pier

8. Existing vessel schedule calling at Old Foreign Pier is analyzed using the data of PPA Monthly Report 1990 May, which are shown in Table 6-4 and Table 6-5.

Table 6-4 Vessels arriving at Old Foreign Pier
(1990, May)

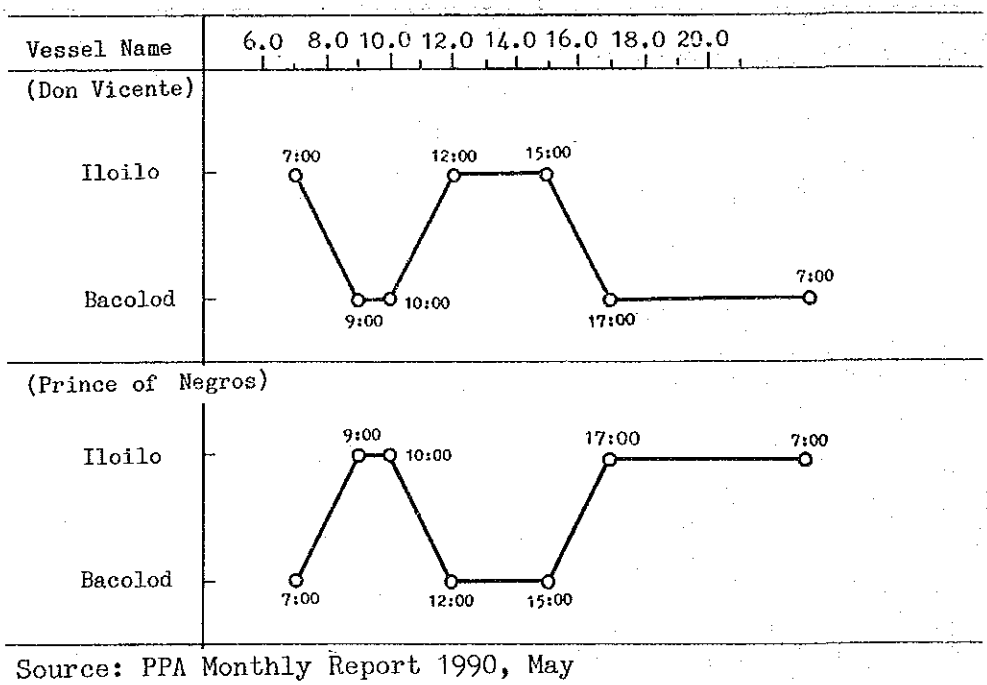
Vessel Name	Name of Co.	Type of Service	Type of Vessel	G.R.T	L (m)	D (m)	Frequency
Sta.Florentina	Negros.N	regular	P/Fe	4,343	108		1/week
Don Jurio	do	do	P/CA	2,381	96		1/week
Don Cloudio	do	do	G.C	2,863	92		3/week
Sta.Ana	do	do	P/Fe	7,909	118	6.2	2/week
Cotabato Princese	Sulpicio	do	P/Fe	7,977	149	4.7	2/week
Phlippine Princese	do	do	P/Fe	4,717	125	5.6	2/week
Asia Koria	Trans-Asia	do	P/Fe	1,842	76	3.8	2/week
Wilcon 2	Willian.L	N.regular	Cargo	130 TEU	83	4.5	1/week
Don Vincente	Negros.N	Regular	Fe	1,070	70		1.5/day
P.O.Negros	do	do	do	543	61		1.5/day

Source: PPA Monthly Report 1990.

Table 6-5 Current Liner Vessel Arrival Schedule at Port of Iloilo

Vessel Name	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
(Old Forign Port)								
Sta. Ana (7907 GRT)	10:30 – 17:00		5:30 – 10:00		11:00	10:00		
Sta. Florentina (4343 GRT)			13:30	12:30				
Don Cloudio (2381 GRT)							10:30 – 18:00	
Don Julio (2381 GRT)	17:00	13:00						
Cotabato Princess (7977 GRT)		17:30	1:00			11:00 – 13:00		
Philippine Pricess (4717 GRT)		8:30 – 14:00			8:45 – 17:00			
Asian Korea (1842 GRT)	11:30 – 19:00					11:30 – 16:00		
			ILOILO-BACOLOD FERRY					
Willcon II(G.C) 2249						18:00	8:30	
(International C.Complex)								
Super Ferry (4511GRT)			6:00 – 2:00					

Time Schedule of Iloilo-Bacolod Ferry



Source: PPA Monthly Report 1990, May

9. Table 6-6 shows the comparison of existing berth length and vessels' length which use the berths at the same time. The table indicates that the berth length is already 28 m short for accommodating the vessels on Thursday. At the time of the site investigation, it was also observed that the berth was insufficient to accommodate the whole vessel.

Table 6-6 Critical Berth Utilization of Old Foreign Pier

Week Day	Vessel Name	G.R.T	L (m)	D (m)	Required B.Length(m)	Required W.Depth(m)	Shortage B.Length
	Sta.Ana	7,907	118	6.2	138	7.8	
	Asia Koria	1,842	76	3.8	96	5	21
Sun	*Don Vincente	1,070	70		90	4.5	
	Total		264		324		
	Sta.Ana	7,907	118	6.2	138	7.8	
	Philippine.P	4,717	125	5.6	145	6.8	28
Thu	*Don Vincente	1,070	70		90	4.5	
	Total		313		373		
	Cotabato.P	7,977	149	4.2	169	5.9	
	Asia Koria	1,842	76	3.8	96	5	10
Fri	*Don Vincente	1,070	70		90	4.5	
	Total		295		355		

Note ; Existing Berth Length = 345 m
; * = Existing Iloilo - Bacolod Ferry
Source: JICA Study Team based on PPA Monthly Report 1990,May

Required Facility

10. The length of the vessel of a 2,000 grt vessel is 96 m. The present Iloilo/Bacolod ferry vessel is 76 m length, which means that the shortage of berth length will increase by 20 m.

11. The Ro/Ro ramp is designed to be 32 m in length as shown in Figure A-2-6-1. Thus the total shortage of berth length in 2010 is estimated as follows;

Shortage of Berth Length at 2010 = Existing shortage length + Shortage length from the change of vessel size + Ro/Ro Ramp

= 28 m + 20 m + 32 m = 80 m

12. Ro/Ro transport also requires a parking area and a passenger terminal, the dimensions of which are projected in F, Chapter 11, Volume I. The facilities required for Ro/Ro terminal are summarized in Table 6-7.

Table 6-7 Facilities Required for Ro/Ro Berth

By the year 1997	
Berth number	2,000 grt.class:1 (berth length 115m,water depth -5.5m)
Parking Area	: 1 (2,000 m²)
Passenger Terminal	: 1 (600 m²)
Ramp	: 1 set (length 32 m)
Additional Berth by the year 2010	
Number and dimensions are same as above	

Source: JICA Study Team

Layout Plan Alternatives of Port of Iloilo

13. In order to ensure the most adequate layout among various ideas in this regard, the team proposed the following two alternatives:

Alternative 1 : This alternative is based on an idea to expand the existing berth in the north direction by the shortage distance. The layout plan is shown in Figure 6-5.

Alternative 2 : This alternative is based on an idea to expand the existing berth to the south direction by the shortage distance. The layout plan is shown in Figure 6-6.

Evaluation of the Layout Plan

14. While the Old Foreign Pier is blessed with good natural conditions (90% calmness and shallow base lay of foundation) and although in general terms calm water area in front of the new berth provides sufficient area for maneuvering of ships, there may still be some apprehension concerning ships' maneuvering particularly when heading with current and wind. However, this can be solved by proper steering as follows.

15. When berthing a ship in a stream (1 to 2 m/sec along the berth), a possible routine practice is illustrated in Figure 6-7, 6-8.

(i) When heading against a stream, the ship should be brought to a position slightly upstream of the berth, in an attitude parallel to the berth. The offshore anchor should then be let go, and with killing speed, the ship should be allowed to fall down with the stream, veering cable meanwhile, until she is almost abreast of the berth. With a taut cable, if the helm is now thrown over toward the side on which the berth lies, the ship may be sheered in sufficiently far enough to get lines ashore.

(ii) When heading with a stream, the ship should be brought to a position slightly before (about a half length of the ship) the berth, with the slowest possible speed, in an attitude parallel to the berth. The offshore anchor should

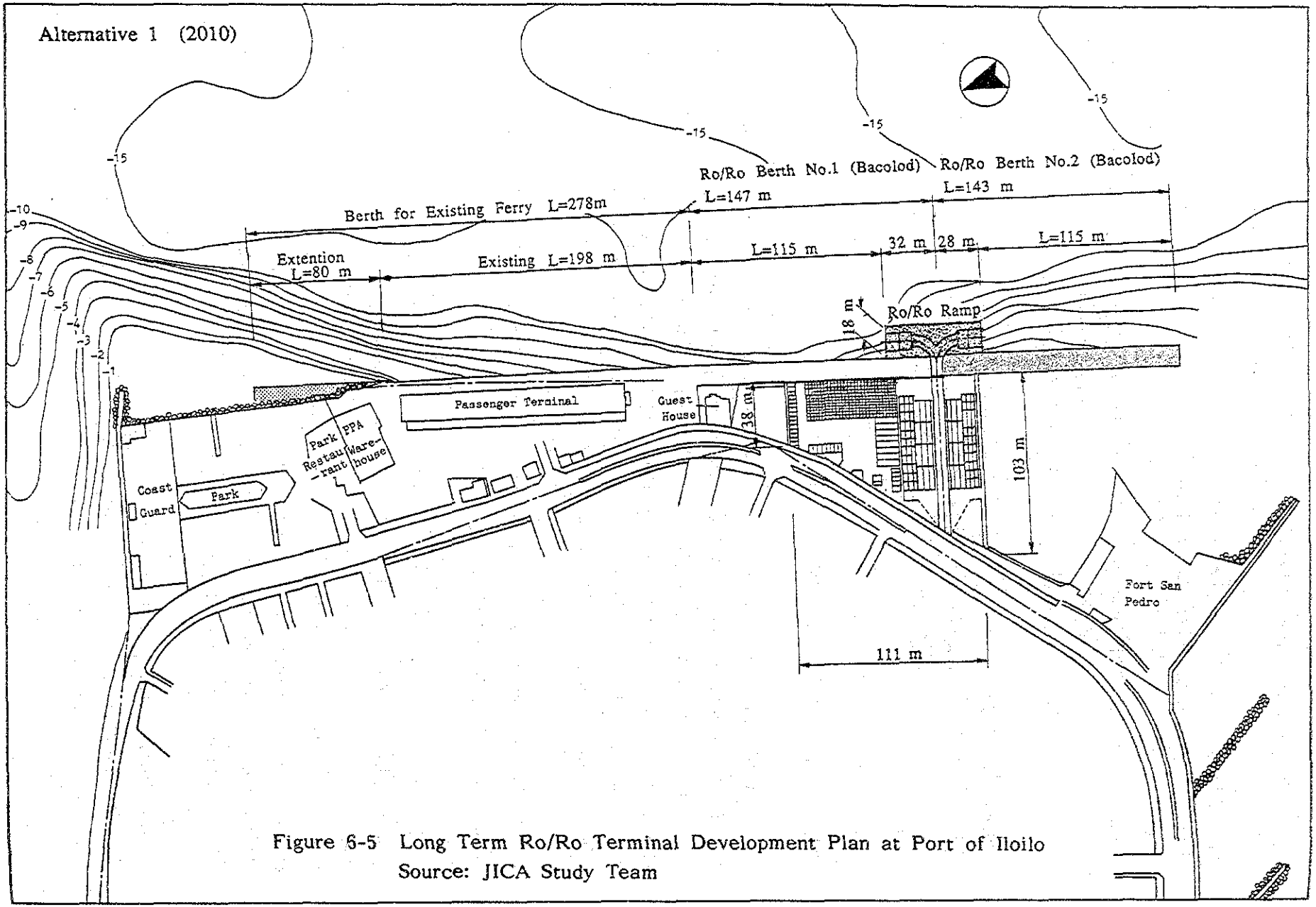


Figure 6-5 Long Term Ro/Ro Terminal Development Plan at Port of Iloilo
Source: JICA Study Team

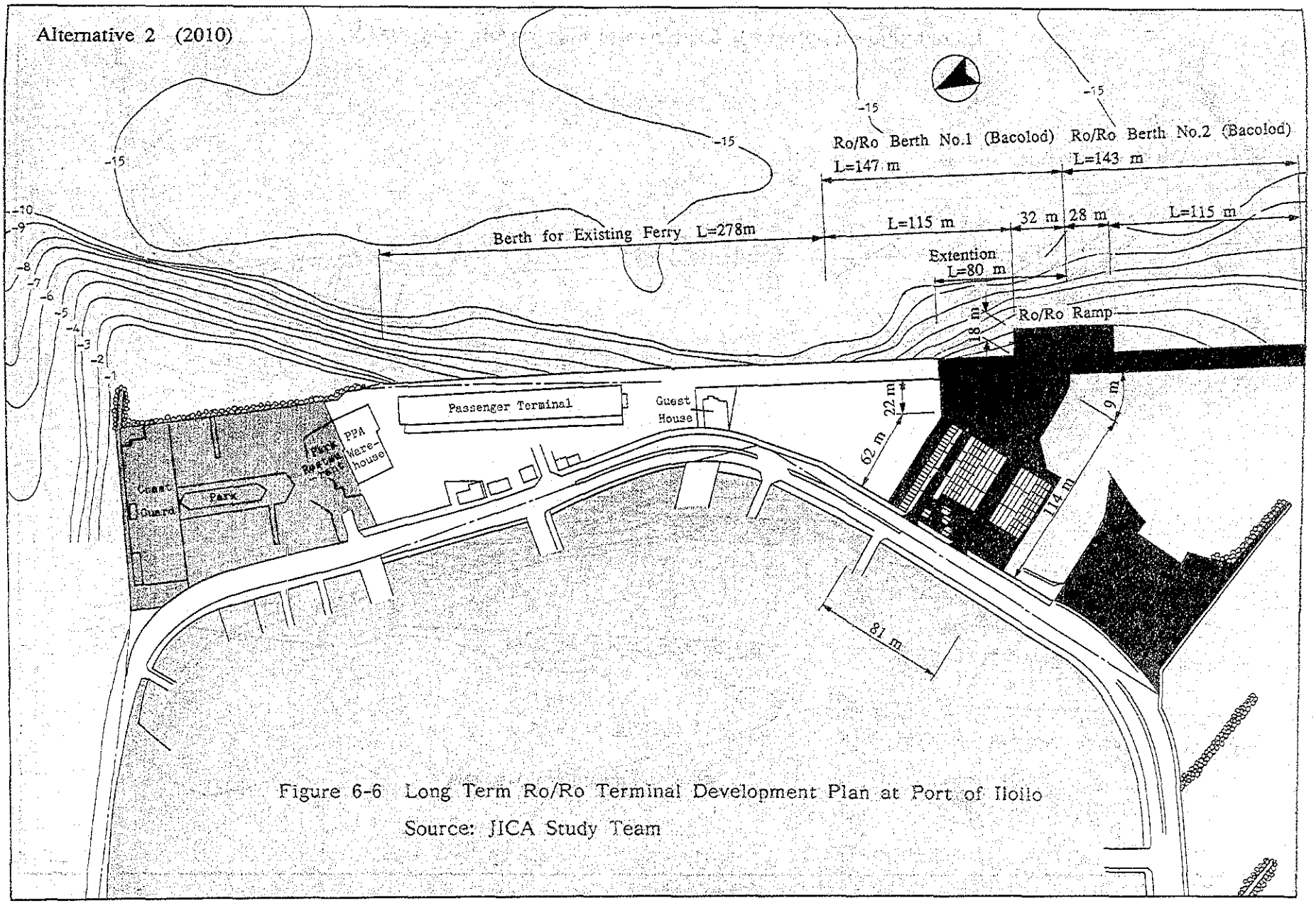


Figure 6-6 Long Term Ro/Ro Terminal Development Plan at Port of Iloilo

Source: JICA Study Team

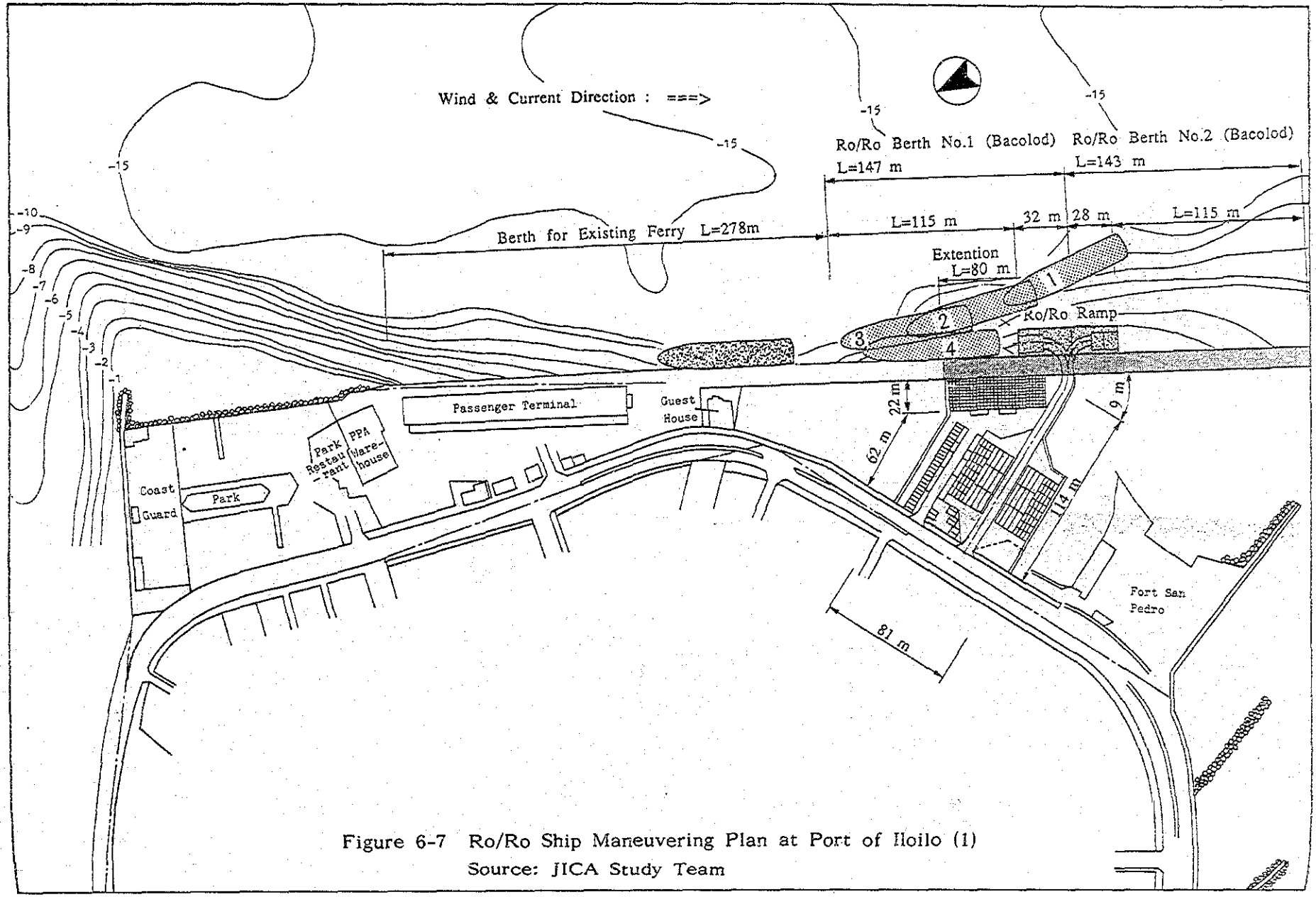


Figure 6-7 Ro/Ro Ship Maneuvering Plan at Port of Iloilo (1)

Source: JICA Study Team

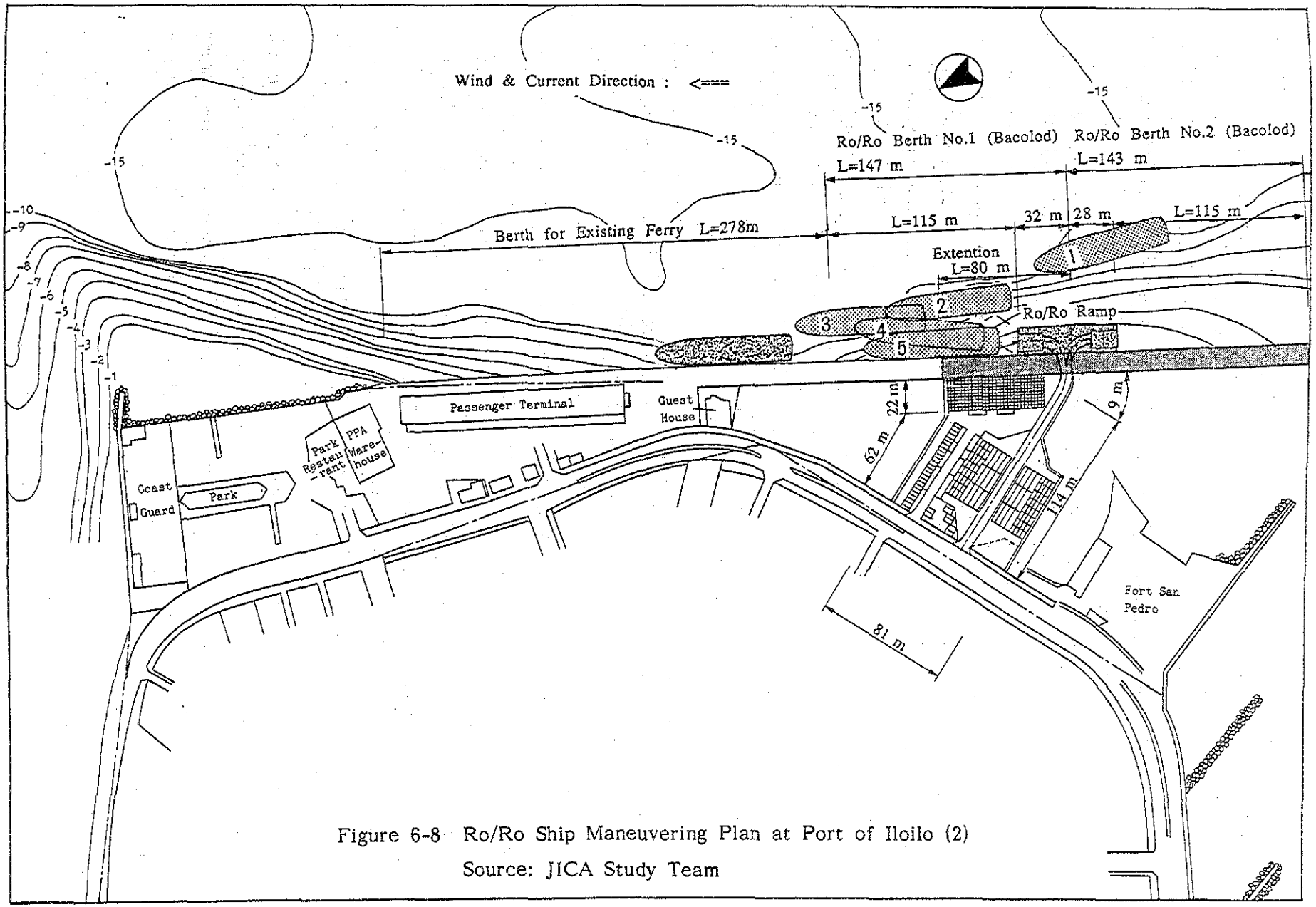


Figure 6-8 Ro/Ro Ship Maneuvering Plan at Port of Iloilo (2)

Source: JICA Study Team

then be let go, ground speed should be reduced, veering cable meanwhile, until she is almost abreast of the berth. After that maneuvering is same as above.

16. Aside from the above common issue, each alternative has its inherent advantages and disadvantages.

In Alternative 1, since the plan calls for construction of a series of quays near the mouth of the Iloilo river, the impact on the view of the Sta. Maria statue which is one of the landmarks of the city, is smaller than the other alternative. On the other hand, an expanded part of the quay is to be constructed in front of a green square next to the river mouth which is in close proximity to a restaurant and an office building owned by some private and public interest. Therefore, the constructor needs to obtain approval from landlords and building owners, which might affect the schedule of the public work.

Cost of Alternative 1 construction is estimated at 184 million pesos which is slightly higher than that of Alternative 2.

17. In Alternative 2, to construct a series of quays more remote from the mouth of the Iloilo river, the new quay is nearer to the statue. However this alternative has following locational advantages:

(i) For the moment, the expanded quay does not affect the usage of the green square. Also, the quay will be free from siltation by river sand.

(ii) For the future, Alternative 2 will have more expansion area to the north than Alternative 1. This point may become critical in terms of future transport development of the port, because the vessel size of the other route is expected to be larger, eg. routes covered by 2,000 grt. type vessel may be served by 3,000 grt.(140 m at length) and those covered by 7,000 grt. may be served by 10,000 grt.(220m at length). This means that the remaining length of the existing quay and the one which is expanded for Ro/Ro transport between Iloilo and Bacolod would be 82 m and be too short to accommodate the larger vessels. The area in front of the green square may be reserved for such a situation.

18. The cost of Alternative 2 is around 179 million pesos, five million pesos less than Alternative 1.

From the above observation, it is concluded that Alternative 2 is the more adequate layout plan for the future development of the link.

C. Layout Plan of Port of Bacolod (Alternatives and Evaluation)

19. Required facilities for the link are the same as in port of Iloilo which are described in paragraph 12 of this chapter.

20. For the port of Bacolod also, two alternatives are drafted as follows;

Alternative 1 : This alternative is based on an idea to expand the new pier out of the existing Banago berth to the west direction so as to acquire the enough length for other calling vessel berthing.

The passenger terminal is planned close to the berth. However, a parking area for loading is planned at the foot of the pier causeway for the economy of construction. The layout plan of this is shown in Figure 6-9.

Alternative 2 : This alternative is based on a idea to expand the new pier in the same direction of existing Banago berth at a point with enough water depth for future Ro/Ro vessel.

The location of parking area for loading is the same as in Alternative 1. The layout plan of this is shown in Figure 6-10.

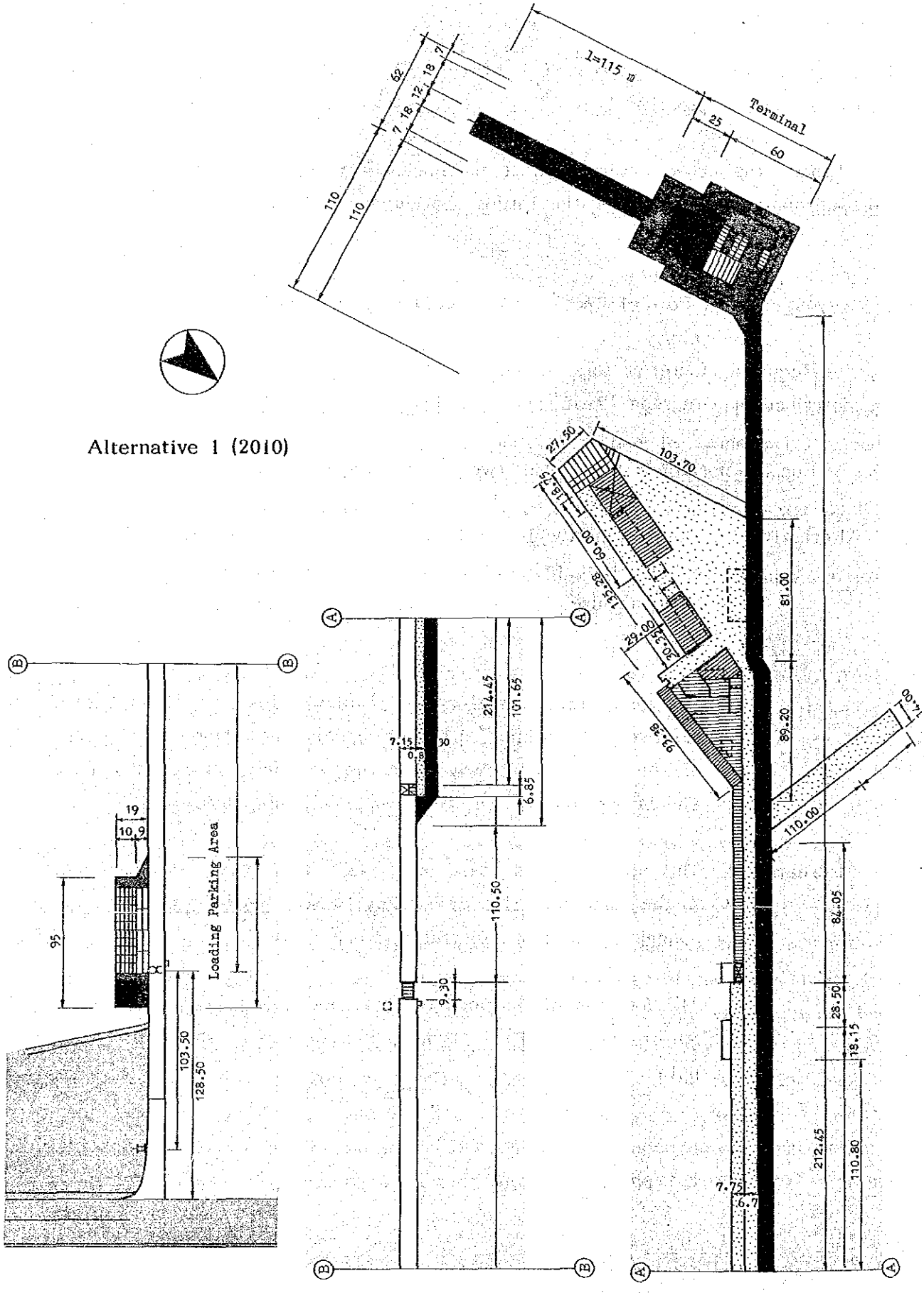


Figure 6-9 Long Term Ro/Ro Terminal Plan of Port of Bacolod

Source: JICA Study Team

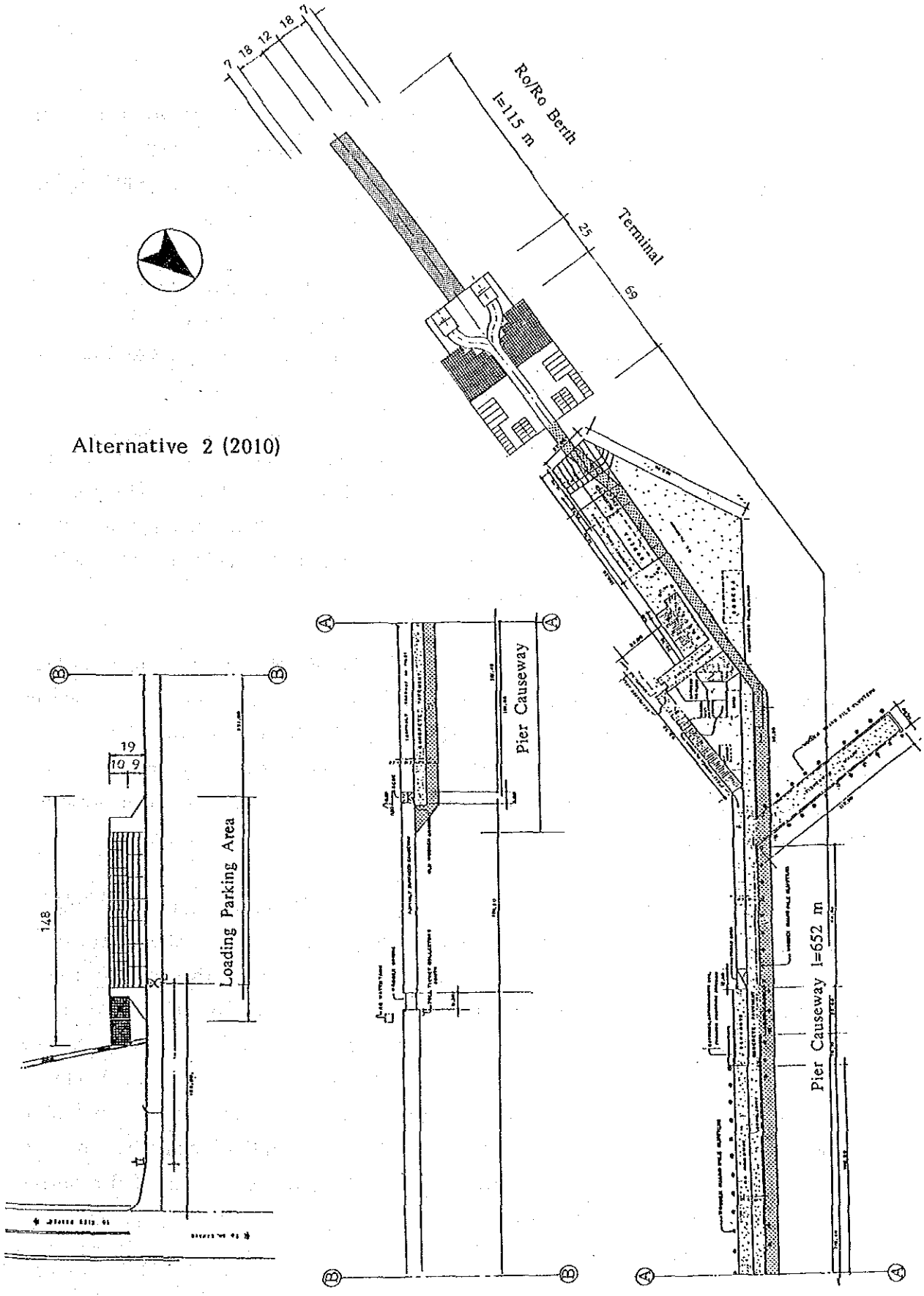


Figure 6-10 Long Term Ro/Ro Terminal Plan of Port of Bacolod

Source: JICA Study Team

Evaluation of the Layout Plan

21. The site selected for Ro/Ro operation of the link is blessed with better natural conditions than port of Iloilo, with almost every day being workable. With the 0.7 m/sec. current flow and a wide deep water area, ships can be maneuvered safely irrespective of the alternatives.

22. For accommodating future increase of ship numbers and enlargement of the size in the other than Iloilo/Bacolod link, a comprehensive development plan of the port is required since it is unthinkable that only the Banago Pier can manage the situation whichever alternative is selected.

23. The difference between the two alternatives are construction cost and impact on cargo handling at existing berths. However, the difference of construction cost is 6 million pesos (Alternative 1 = 233 million pesos, Alternative 2 = 227 million pesos) which is not imperative for judging the advantages and disadvantages of both alternatives.

24. In Alternative 2, the approach road to the Ro/Ro berths runs through the center of the existing pier. Not only is the cargo handling area reduced, but cargo and container flow will be hindered by the Ro/Ro traffic since warehouses and an open shed exist around the approach road. This point dictates the selection of Alternative 1 as the appropriate alternative for the terminal plan of Bacolod for 2010.

25. In planning the layout of Alternative 1, two variations can be considered. One is a plan in which the approach way passes around the new Ro/Ro terminal(see Figure 6-9), and the other is a plan in which the approach way passes through the new terminal (see Figure 6-11). While in the first plan, traffic is able to run through the way without any hindrance, in the second plan, passenger flow on the approach way may be interfered by movement of cargoes and cars within the terminal(see Figure 6-12). Also the terminal area of the first plan is 5,000 sq.m, that is 400 sq.m smaller than that of the second plan. With these considerations in mind, the first plan (Alternative 1,Figure 9) is the one to be chosen.

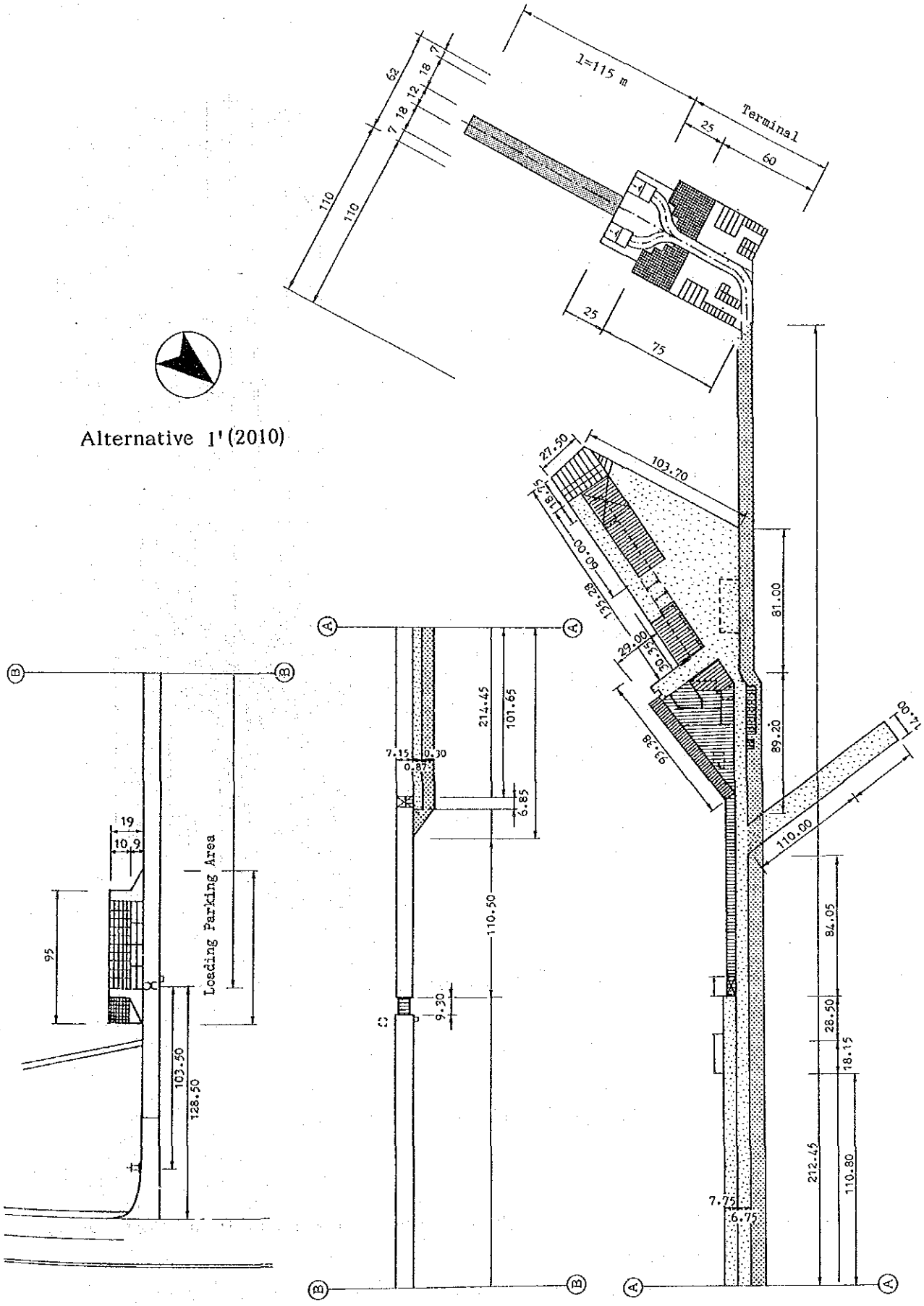


Figure 6-11 Long Term Ro/Ro Terminal Plan of Port of Bacolod

Source: JICA Study Team

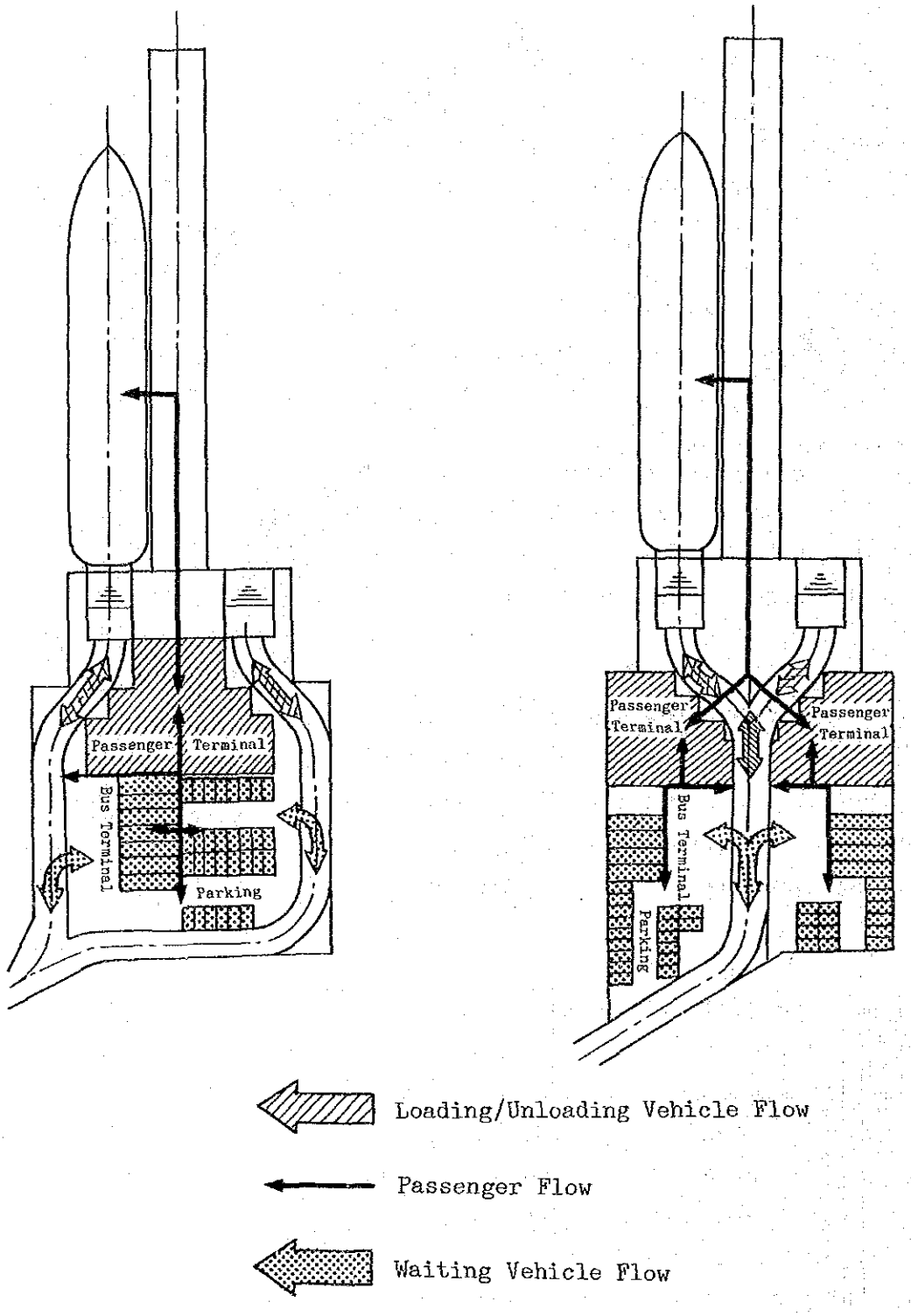


Figure 6-12 Passenger/Vehicle Flow of Alternative 1 and 1' in Port of Bacolod

Source: JICA Study Team

[References]

1. Implementation program for feeder ferry development project, DPWH, January 1986.

2. Feeder port study, Asian Development Bank, October 1989.

3. Review of transport project in the MTPIP,1987-1992.
NEDA, DOTC, DPWH, PNR, PPA, MARINA, January 1988.

4. DPWH Infrastructure atlas, DPWH, 1988.

5. Technical standards for port and harbor facilities in Japan 1991, OCDI

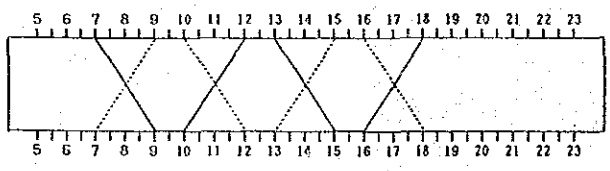
Chapter 7 Short Term Ro/Ro Terminal Plan

A. Required Ro/Ro Terminal Facility

1. Ro/Ro demand for 1997 is estimated 1,236,000 for passengers and 81,000 MT for cargo as described in D, Chapter 4, Volume II. In order to satisfy the demand, four voyages using 2,000 grt. Ro/Ro vessel is required. Two vessels leave Iloilo and Bacolod simultaneously at 07:00 and arrived at their final destination at 18:00. This sailing schedule requires only one berth for each port.

2. Two vessels have a carrying capacity of 96,900 metric tons of cargo and 1,360,000 passengers annually which can meet forecasted volume of 81,000 metric tons of cargo and 1,236,000 passenger respectively on the condition that loading utilization of each vessel reaches 65 per cent capacity. These conditions are summarized in Table 7-1.

Table 7-1 Summary of Ro/Ro Ship Operation in 1997

Vessel & Facility	Time Schedule
Vessel= 2 Berth No. = 1 /Iloilo = 1 /Bacolod	

Source: JICA Study Team

3. The composition of transported vehicle is assumed as shown in Table 7-2.

Table 7-2 Assumed Composition of Vehicle on Board

Car Type	Number
Bus	3
Private Car	8
Truck	6
Jeepney	49

Source : JICA Study Team

4. The required Ro/Ro terminal facilities are summarized in Table 7-3. More detariled figures are shown in Note A-2-7-1.

Table 7-3 Summary of Required Facilities of Short term Plan in Iloilo and Bacolod

Port	Item	Required Area
(Iloilo)	Apron	115 m * 12 m
	Parking Area	2,300 m²
	Loading	1,500 m²
	Waiting	800 m²
	Passenger Terminal	600 m²
	Total	2,900 m²
(Bacolod)	Apron	115 m * 12 m
	* Loading Parking Area	1,500 m²
	Waiting Parking Area	800 m²
	Passenger Terminal	600 m²
	* Utilized Area at Loading Parking	150 m²
	Off Shore Total	1,650 m²
	On Shore Total	1,400 m²

Note : * = On shore Terminal Facilities
Source : JICA Study Team

B. Layout Plan for 1997

5. The short term layout plan of Ro/Ro terminal at both ports is based on the long term Ro/Ro terminal plan. The layout plans are illustrated in Figure 7-1 and 7-2. The passenger/vehicle flow on the terminal should be separated for the safety of passengers. The traffic schemes shown in Figure 7-3 and 7-4 are drawn up with that idea in mind.

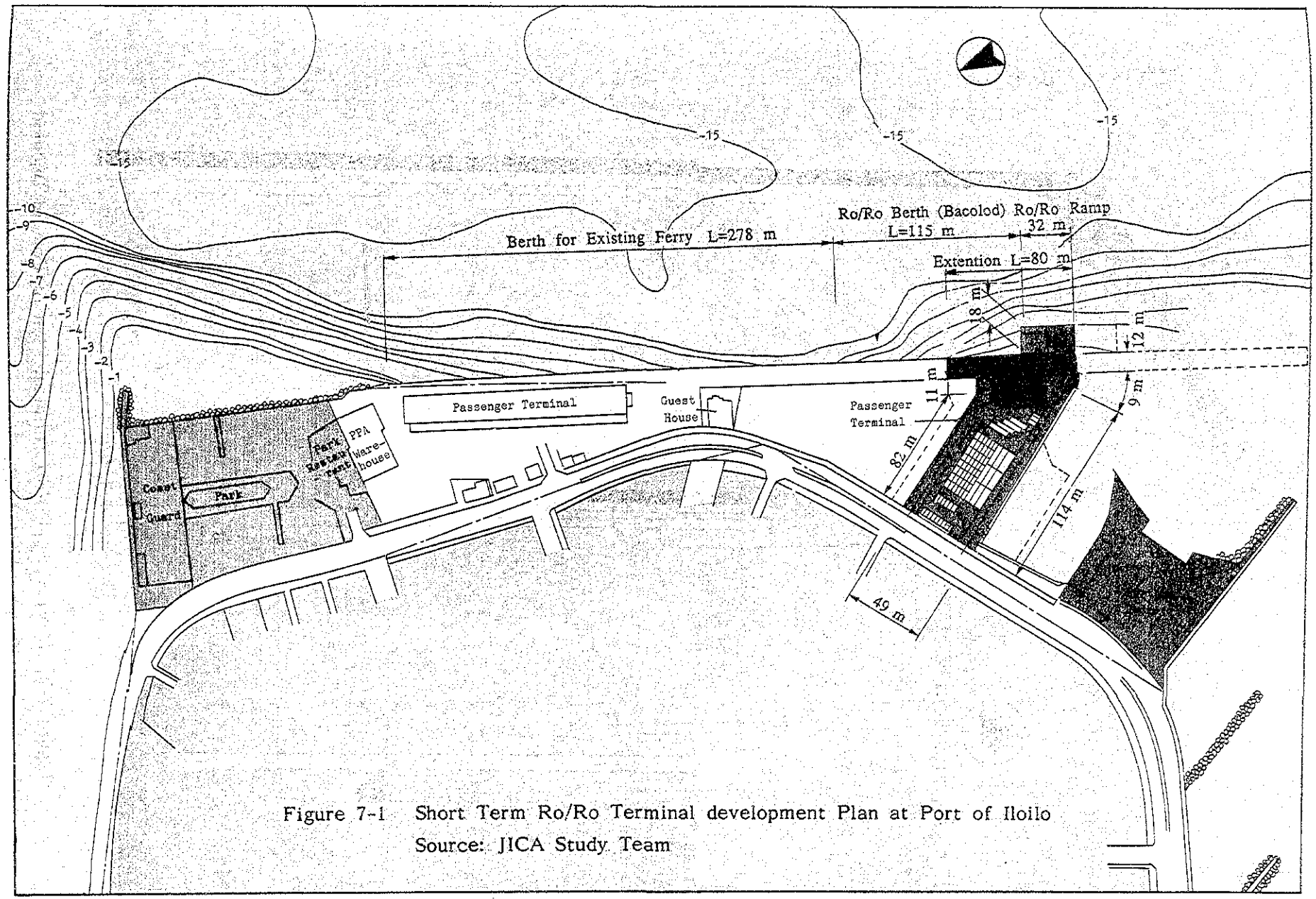


Figure 7-1 Short Term Ro/Ro Terminal development Plan at Port of Iloilo

Source: JICA Study Team

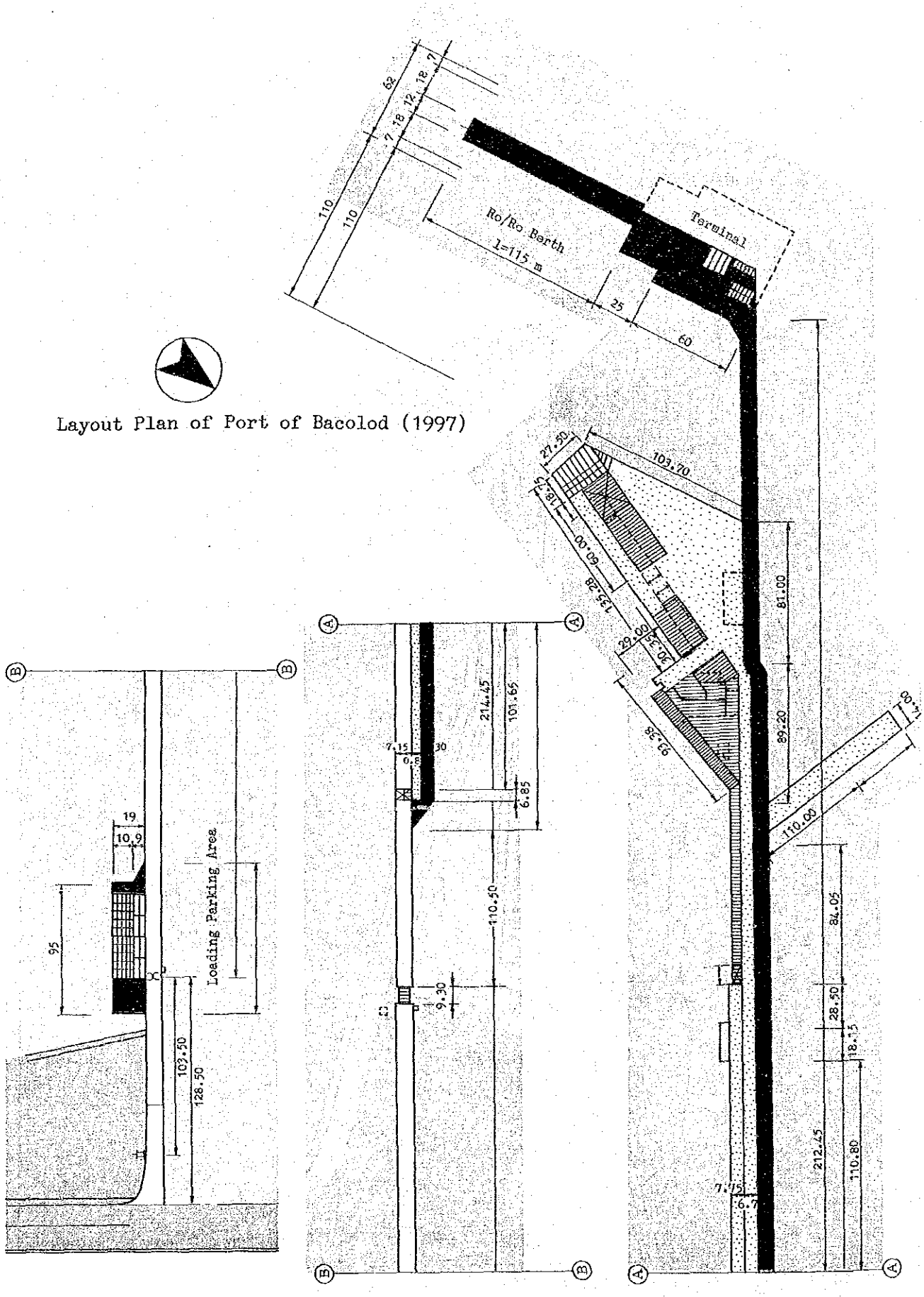


Figure 7-2 Short Term Ro/Ro Terminal Plan of Port of Bacolod

Source: JICA Study Team

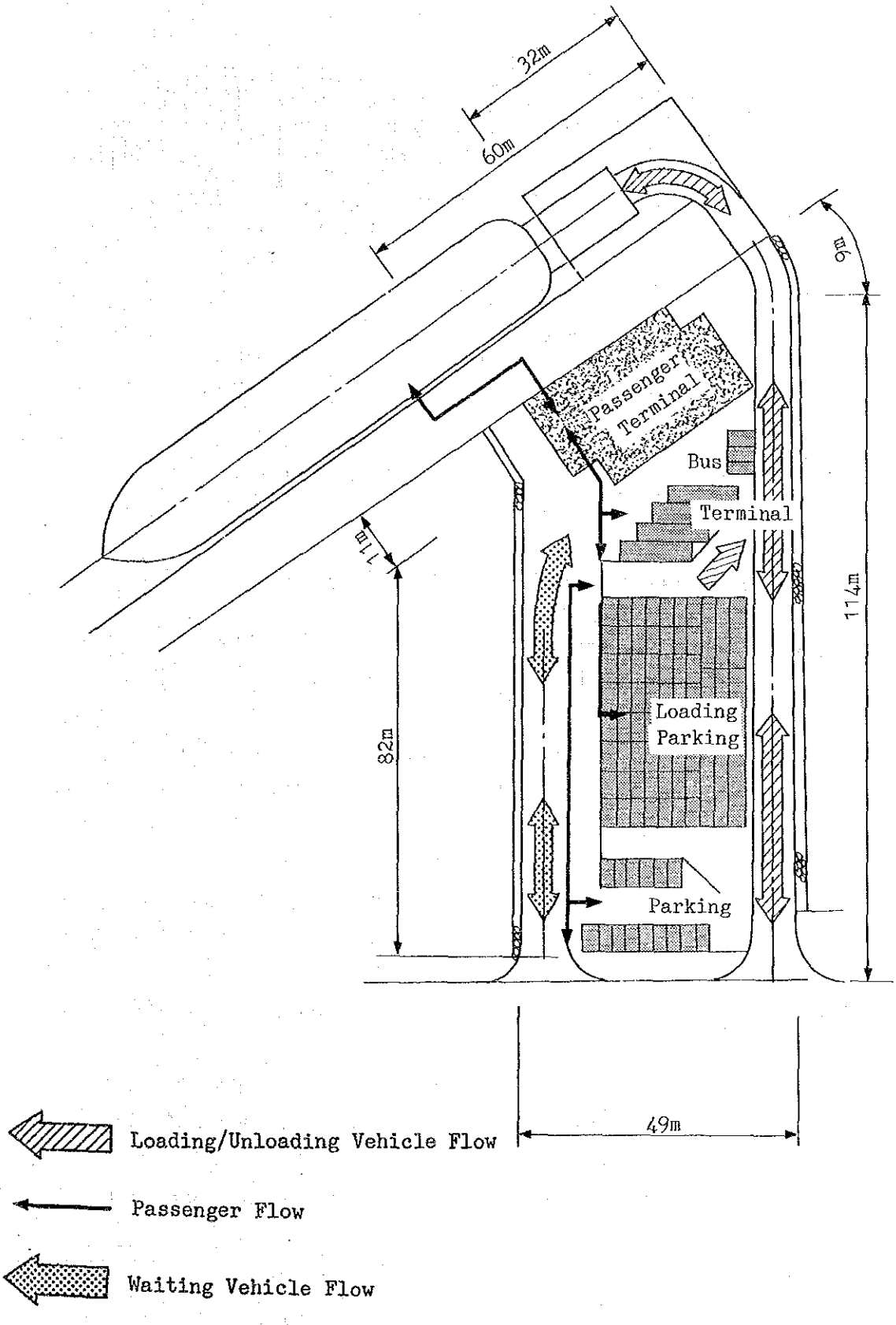


Figure 7-3 Passenger/Vehicle Flow of Port of Iloilo

Source: JICA Study Team

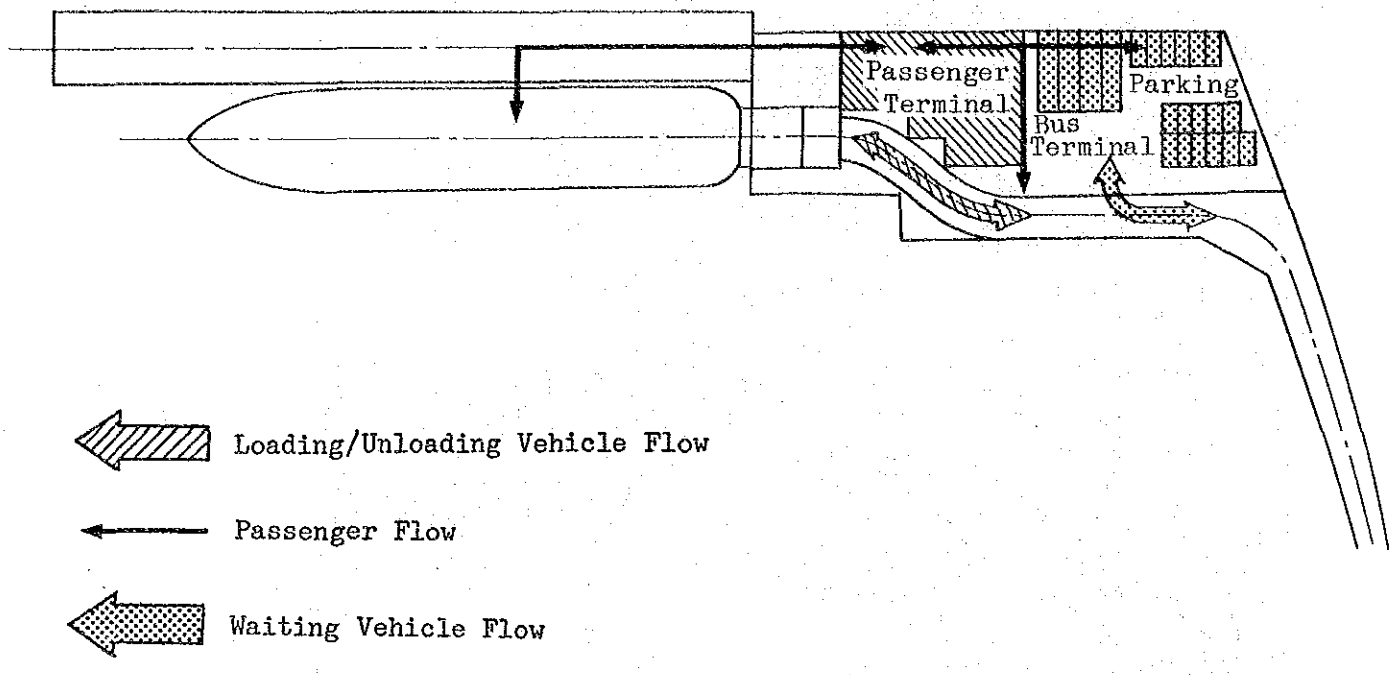


Figure 7-4 Passenger/Vehicle Flow of Port of Bacolod
Source: JICA Study Team

C. Passenger/Vehicle Control Plan in the Terminal

6. Loading/discharging vehicle should be properly controlled for traffic safety. Passenger traffic within the terminal should also be controlled more strictly than with usual ferry service. The flow of vehicle/passenger is shown in Figure 7-5.

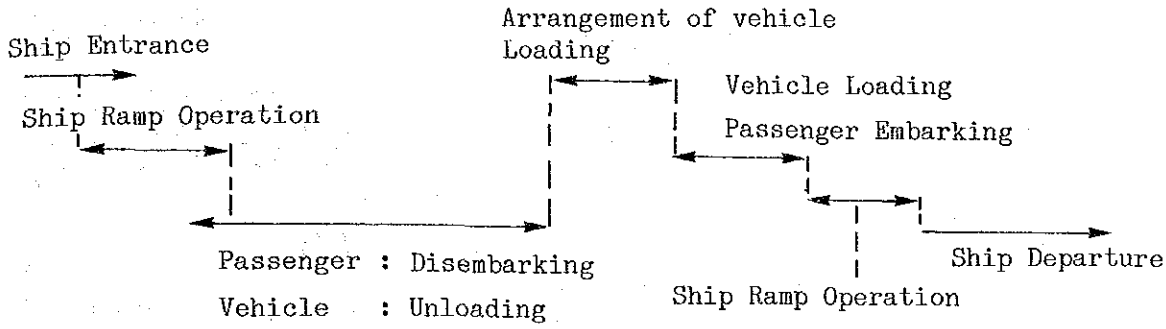


Figure 7-5 The Flow of Vehicle/Passenger
Source: JICA Study Team

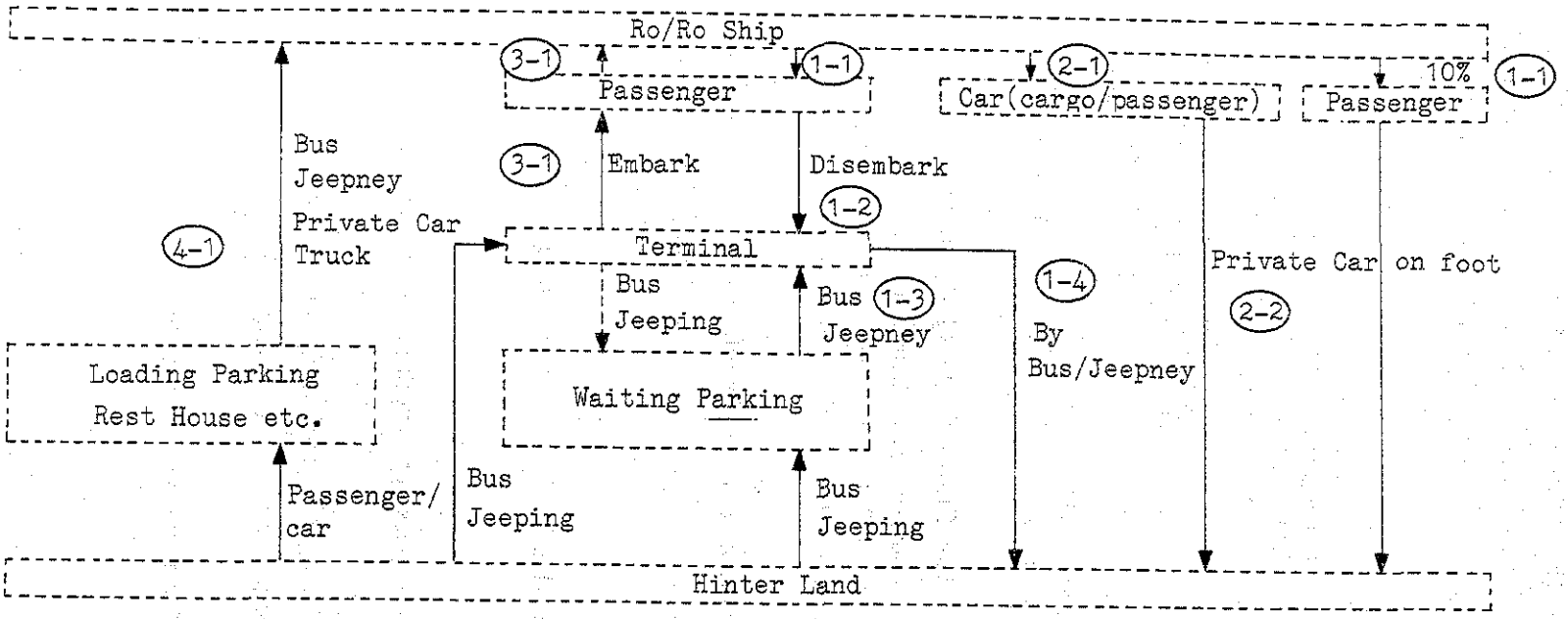
7. A passenger/vehicle control scheme should be worked out to enhance the efficiency and traffic safety at the port. Figure 7-6 shows the control scheme of the terminal.

8. The parking system at the loading/waiting parking area is illustrated in Figure 7-7.

9. Other required items for passenger/vehicle flow control are as follows;

(i) Marking signs and signs indicating information
(ii) Marking signs and signs indicating instructions

The examples of above facilities are shown in Figure 7-8.



Operation Schedule

Loading/
Discharging
flow

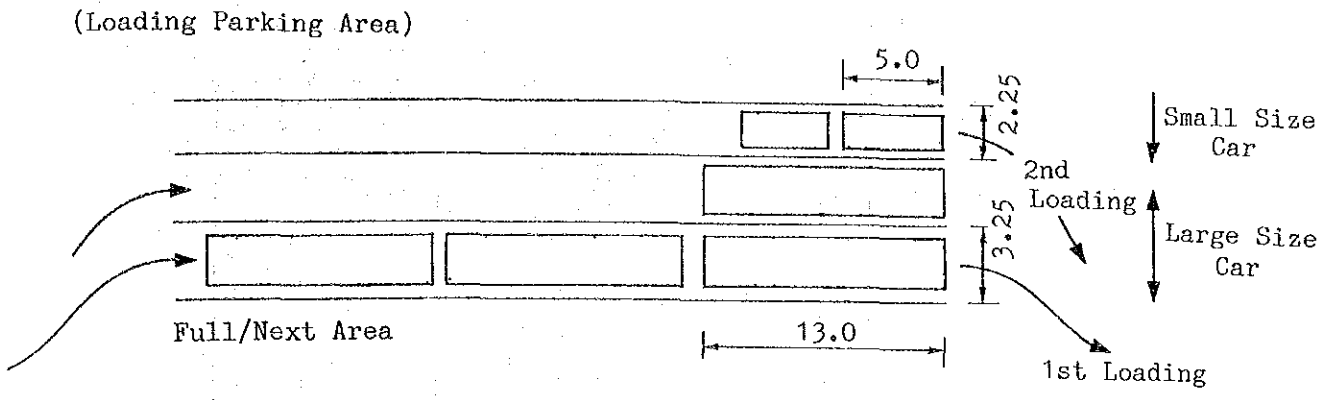
Phase 1. Disembarking of Passenger(1-1 ~ 1-4 , 1-1)

Phase 2. Discharging of Car(cargo/passenger) (2-1)

Phase 3. Embarking of Passenger (3-1)

Phase 4. Loading of car (cargo/passenger) (4-1)

Figure 7-6 Terminal Operation Plan at Iloilo & Bacolod



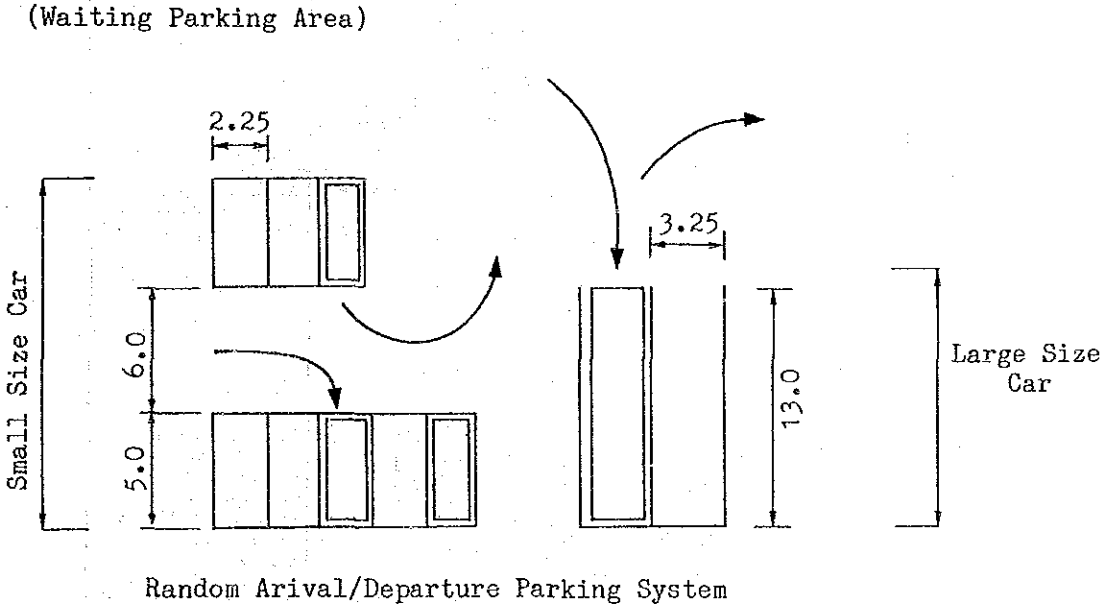


Figure 7-7 Parking System at the Loading/Waiting Parking Area
Source: JICA Study Team

(Unit: cm)

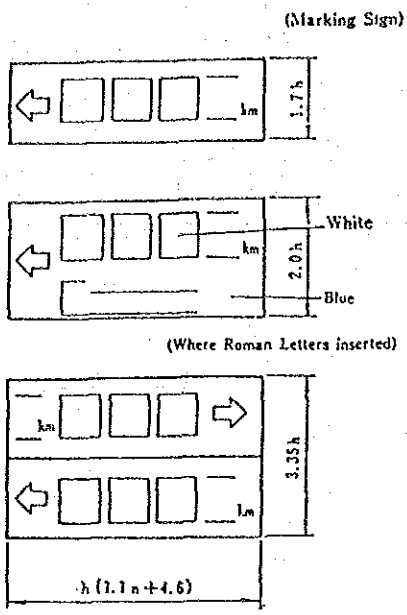
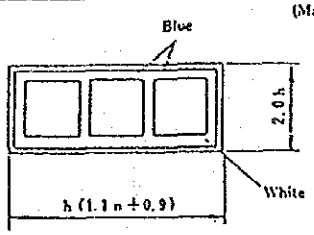
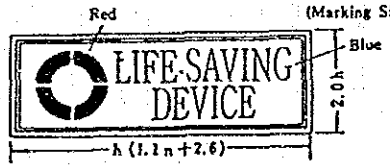
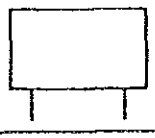
Symbol	Type	Form	Place of Installation
A-11	Direction and distance to the destination	(Marking Sign)  h: Size of character n: Number of characters	Roadside within 30m to the intersection of the road leading to the place of indication, and other necessary places
A-21	Location of facility	(Marking Sign) 	At the entrance and in front of the facility.
A-24	Location of life-saving device	(Marking Sign) 	Appointed place of installation of the life-saving divice on the quaywall, or its neighborhood which can be seen from the quaywall
A-25M	Bitt No. indication	The color of numerical figures is white, the size of the figure is dependent on the size of the bitt.	On the back of the bitt (sea side)
A-31	How to use the facility	 To be written laterally as a rule. The colores of characters are black or red on white board. The size is not specified.	In front of the facility, and other necessary places
A-41	Information map	In any desirable form	Place readily visible for the users

Figure 7-8 Required Items for Passenger/Vehicle Flow Control (Marking Signs and Sings Indicating Information)
Source: Technical Standards for Port and Harbour Facilities in Japan 1990,OCDI

(Unit: cm)

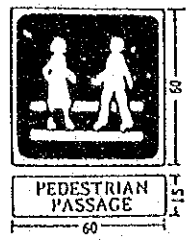
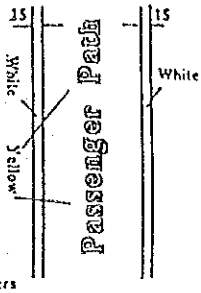
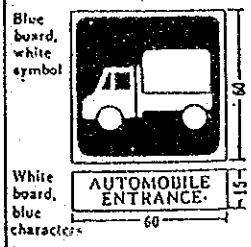
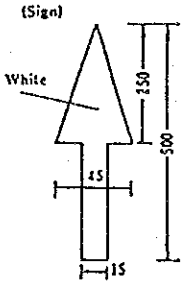
Symbol	Type	Format	Place of Installation
C-21 C-21M	Pedestrian passage	(Marking Sign) Blue board, White symbol  White board, blue characters (Sign)  	Marking Sign: At the starting point of a pedestrian passage Sign: Sections specified as pedestrian passage in the cargo sorting yard, open storage yard, apron, parking area and facilities for passegers to board and alight.
C-31 C-31M	Automobile entrance.	(Marking Sign)  (Sign)  	Marking Sign: Roadside of a passage or entrance admitting entry only to an apron, cargo sorting yard, parking area, etc. Sign: On the road surface of said passage.

Figure 7-8 Required Items for Passenger/Vehicle Flow Control (Cont.)

(Marking Signs and Signs Indicating Instruction)

Source: Technical Standards for Port and Harbour Facilities in Japan 1990,OCDI

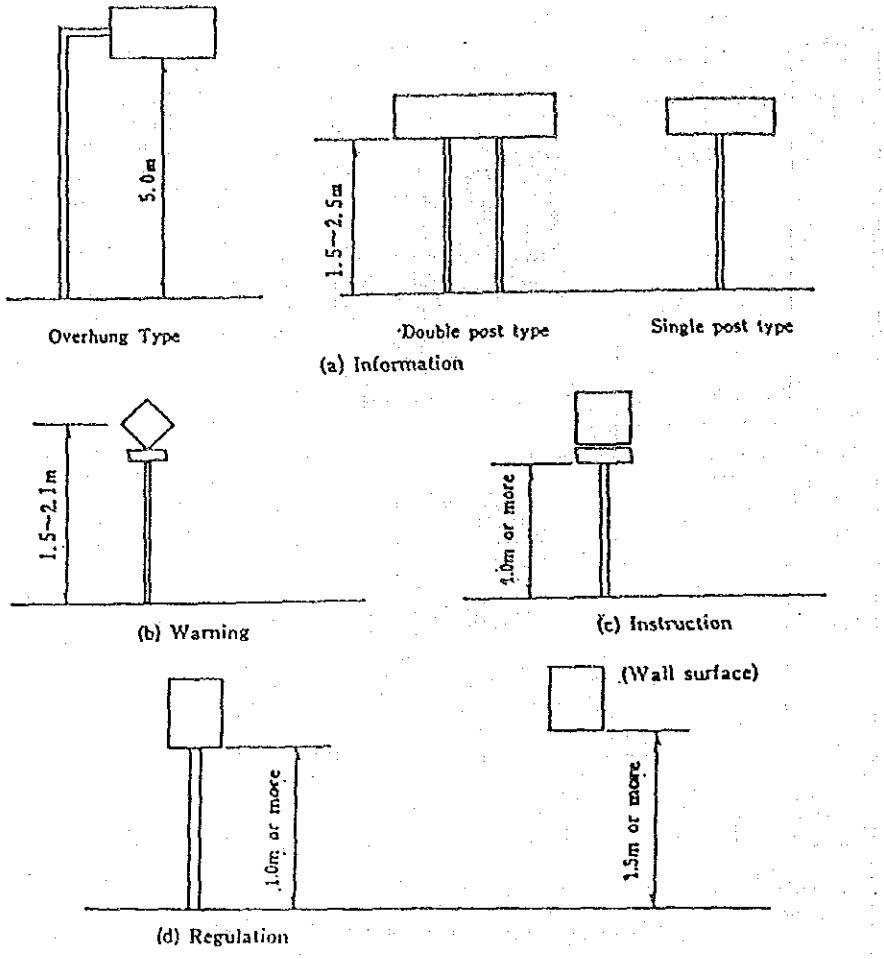


Figure 7-8 Required Items for Passenger/Vehicle Flow Control (Cont.)

(Hight of Marking Signs)

Source: Technical Standards for Port and Harbour Facilities in Japan 1990,OCDI

[References]

1. Implementation program for feeder ferry development project, DPWH, January 1986

2. Feeder port study, Asian Development Bank, October 1989

3. Review of transport projects in the MTPIP, 1987-1992 NEDA, DOTC, DPWH, PNR, PPA, MARINA, January 1988

4. Technical standards for port and harbour facilities in Japan 1983, Bureau of Ports and Harbors and Port and Harbor Research Institute MOT

Chapter 8 Design

A. Design Criteria

1. The preliminary design has been performed based on the followings:

- Technical Standards for Port and Harbors Facilities, Japan, 1980
- National Structural Code of the Philippines, Association of Structural Engineering of the philippines,1987

2. Under certain combination of loads, the following safety factor 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 %

3. Typical dimension of Ro/Ro vessels is as follows;

Size:	2000 grt.
Length:	96.0 m
Width:	17.1 m
Draft:	4.4 m

4. Berthing force and Mooring Bitt Capacity

(i) Tractive force

Ship Tonnage	Bitt capacity
2,000 grt.	25 ton

(ii) Berthing force

Berthing velosity	:	0.25 m/sec
Max, berthing angle	:	10 degrees
Berthing method	:	quarter point

5. (Wind)

The Phillipines Wind Velocity and Pressure map in National Structural Code is applied for preliminary design.

6. (Wave)

Offshore design waves estimated by wind are as follows:

Iloilo	H1/3 = 1.5m	T1/3 = 3.4sec
Bacolod	H1/3 = 2.3m	T1/3 = 6.2sec

Details of estimation is shown in Note N-2-3-3.

7. (Tide)

Tidal variation are as follows:

	Iloilo	Bacolod
M.H.H.W	1.57 m	2.05 m
M.S.L	0.75 m	1.01 m
M.L.W	0.21 m	0.26 m
M.L.L.W	0.00 m	0.00 m

8. (Current)

Based on the field survey, design tidal current velocity is as follows:

Iloilo: 1.5 m/sec Bacolod: 1.2 m/sec

9. (Soil Condition)

Soil conditions for Iloilo and Bacolod are shown in Table 8-1. Subsoil data on Bore hole No. 1 in Iloilo and Bore Hole No. 2 in Bacolod were utilized for preliminary design. Prior to the actual development of the Ro/Ro ferry terminal at Bacolod, additional subsoil investigation should be conducted covering the construction area to obtain supplementary subsoil data for the detailed design.

Table 8-1 Summary of the Soil Condition

ILOILO

	Depth	Thickness (m)	Soil Clasification	Unit Weight (t/cu.m)	Friction Angle	Cohesion (t/sq.m)	Averaged N-Value
Bore Hole No 1	0 - -1.5	1.5	Silty Sand	2.0	25.0	-	2
	-1.5 - -14.0	13.5	Silty Sand	2.0	30.0	-	11 - 27
	-14.0 - -28.0	14.0	Silty Sand	2.0	35.0	-	30 - 47
	-28.0 -		Silty Sand	2.0	45.0	-	50 over
Bore Hole No 2	0 - -7.0	7.0	Silty Sand	2.0	30.0	-	12 - 27
	-7.0 - -24.0	17.0	Silty Sand	2.0	35.0	-	15 - 48
	-24.0 -		Silty Sand	2.0	45.0	-	50 over

BACOLOD

	Depth	Thickness (m)	Soil Clasification	Unit Weight (t/cu.m)	Friction Angle	Cohesion (t/sq.m)	Averaged N-Value
Bore Hole No 1	0 - -1.5	1.5	Silty Clay	1.4	-	1.0	3
	-1.5 - -7.0	5.5	Silty Sand	2.0	30.0	-	25 - 45
	-7.0 -		Silty Sand	2.0	45.0	-	50 over
Bore Hole No 2	0 - -1.5	1.5	Silty Sand	1.9	30.0	-	11 - 12
	-1.5 - -3.5	2.0	Silty Clay	1.6	-	2.0	3
	-3.5 - -4.5	1.0	Silty Sand	1.8	30.0	-	15
	-4.5 - -11.5	7.0	Silty Clay	1.8	-	15.0	19 - 30
	-11.5 -		Silty Clay	1.6	-	30.0	50 over
Bore Hole No 3	0 - -1.5	1.5	Sand	2.0	30.0	-	11
	-1.5 - -5.0	3.5	Silty Clay	1.6	-	5.0	3 - 4
	-5.0 - -6.0	1.0	Clayey Sand	1.6	-	6.0	11
	-6.0 - -9.0	3.0	Sandy Silt	1.7	-	10.0	20 - 37
	-9.0 - -10.5	1.5	Silty Sand	2.0	45.0	-	50 over
	-10.5 - -13.5	3.0	Sandy Silt	1.6	-	15.0	22 - 33
	-13.5 -		Silty Sand	1.9	45.0	-	50 over
Bore Hole No 4	0 - -2.0	2.0	Sand	2.0	25.0	-	2
	-2.0 - -4.0	2.0	Silty Clay	1.6	-	2.0	-
	-4.0 - -11.0	7.0	Sandy Silt	1.7	-	8.0	11 - 31
	-11.0		Silty Sand	2.1	45.0	-	50 over

Source: JICA Study Team

10. (Load Condition)

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

(i) Dead Load

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

(ii) Live Load

- Uniform live Load
  - 2.0 t/m2 under ordinary condition
  - 1.0 t/m2 under seismic condition
- Wheel Load
  - T-20 (20 ton)

11. (Seismic Factor)

The seismic factor(kh) = 0.15 was applied.

12. (Service Life)

Wharf and Ro/Ro deck is 50 years

13. Allowable stress of concrete and steel material are as follows:

(i) Concrete

	Grade A	Grade B	Grade C	Grade D
Specified compressive strength of concrete (fc')	34.5	24.0	21.0	17.0
Allowable flexural compressive stress (fc')	13.8	10.0	8.0	6.8

unit in MPa

(ii) Steel material (reinforcing - bar)

Maximum Tensile stress	Grade 40 reinforcement	fs = 138 MPa
	Grade 60 reinforcement	fs = 166 MPa

14. The corrosion rates of steel in sea water are assumed as follows:

	Corrosion Environment	Corrosion rate (mm/year)
Sea side	H.W.L. or above	0.39
	Between H.W.L. and sea bed	0.13
Land side	In sea bed	0.04
	In soil (1) (above R.W.L)	0.04
	In soil (2) (below R.W.L)	0.04

B. Preliminary Design

15. Preliminary design for Ro/Ro berth in Iloilo and Bacolod was carried out. Concrete block type, sheet pile wall type and pier with concrete pile type are compared.

16. Table 8-2 shows the summary of design calculation condition . Basis of caluculation and stability of the structures are shown in Table 8-3.

17. Result of the comparative study are summarized in Table 8-4. As suitable type for berthing facility, the pier with concrete piles was selected.

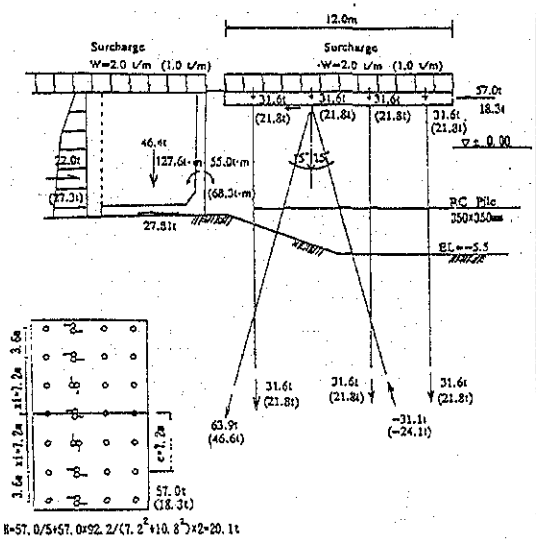
Table 8-2 Summary of Design Calculation Condition

OCEANOGRAPHIC CONDITION	ILOILO	HWL + 1.57m	LWL + 0.00m	H1/3= 1.5m	T1/3= 3.4 Sec.
	BACOLOD	HWL + 2.05m	LWL + 0.00m	H1/3= 2.3m	T1/3= 6.2 Sec.
SOIL CONDITION	ILOILO (BH-1)			BACOLOD (BH-2)	
	-1.5 - -14.0m		N= 11 - 27	-4.5 - -11.5m Ca=10 t/m2	N= 19 - 30
	-14.0 - -28.0m		N= 30 - 47	-11.5 -	N> 50
	-28.0 -		N> 50		
OBJECT VESSEL	SHIP SIZE = 2,000 GRT				
	BERTHING SPEED = 0.25 m/SEC BERTHING ANGLE = 10°				
	BERTHING METHOD : QUARTER POINT				
	BERTHING ENERGY = 9.77 tm			RUBBER FENDER V-type 500H	
SURCHARGE (LIVE LOAD)	UNIFORM LOAD;	2.0 t/m2		(ORDINARY CONDITION)	
		1.0 t/m2		(SEISMIC CONDITION)	
	WHEEL LOAD	T - 20			
CORROSION	ABOVE HWL = 0.39 mm/year, HWL - SEABED = 0.13 mm/year,				
	BELOW SEA BED = 0.04 mm/year,				
SEISMIC COEFF.	Kh = 0.15		LIFE TIME	50 years	

Source: JICA Study Team

Table 8-3(1) Result on Design Calculation (Iloilo)

Pier with Concrete Pile



( )shows the value under seismic condition

Stability of L-Sheped Block

Ordinary Condition

Sliding = UW / P = 0.6 x 46.35 / 22.02 = 1.26 > 1.2
Overturning = Mr / Mt = 127.6 / 55.0 = 2.32 > 1.2

Seismic Condition

Sliding = UW / P = 0.6 x 46.35 / 27.31 = 1.02 > 1.0
Overturning = Mr / Mt = 127.6 / 68.3 = 1.87 > 1.1

Stability of RC Pien

For Coupled Batter pile

	Ordinery Conditon	Seismic Condition
Pushing Force	63.9t	46.6t
Ru	Ru = 30ApN + NAs/5 = 192t	
SF	3.0 > 2.5	4.1 > 2.0
Pulling Force	31.1t	24.1t
Ru	Ru = NAs/5 = 93.7 t	
SF	3.0 > 3.0	3.89 > 2.5

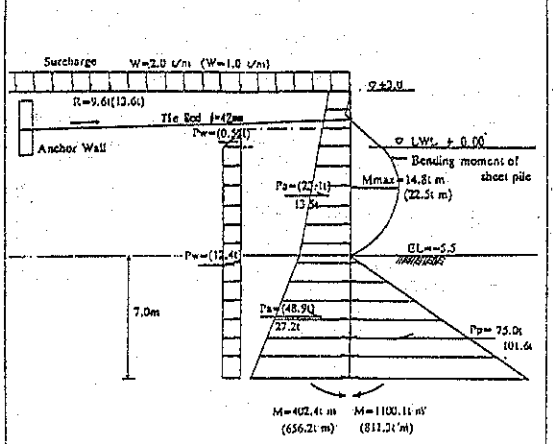
Compressive Stress of pile

i) Vertical Pile 25.8 kg/cm2 < 70 kg/cm2
ii) Batter Pile 52.2 kg/cm2 < 70 kg/cm2

Stress on RC Beam

Maximum Moment 9.0t m
σ = M / z = 1350 kg/cm2 < 1800 kg

Steel Sheet Pile Wall



( )shows the value under seismic condition

Stability of Sheet Pile

Ordinary Condition

MPa = 402.4t·MPa = 1100.1t SF = MPp / MPa = 2.73 > 1.5

Suisnic Condition

MPa = 656.2t·MPa = 811.3t SF = MPp / MPa = 1.24 > 1.2

Maximum Moment on Sheet Pile =14.8t·m (ordinary condition)
(Steel sheet Pile t-type) 22.5t·m (seismic condition)
σ = M / z = 14.8 x 10E5 / 1,230 = 1203 kg/cm2 < 1800 kg/cm2
σ = M / z = 22.5 x 10E5 / 1,230 = 1830 kg/cm2 < 2700 kg/cm2
(z = Reduced its value due to corrosion)

Tie Rod Reaction Force

ordinary condition 9.6t Asreq = 9.6t / 880 kg/cm2 = 10.9cm2
seismic condition 13.6t Asreq = 13.6t / 1320 kg/cm2 = 10.3cm2

Use tie Rod 4.2cm diam (considerring corrosion)
As 13.8cm2

Stability of Ancor Wall

Ordinary condition

sliding Pa + R = 10.5t
SF=Pp/(Pa+Pw)=30.5/10.5=2.9>1.2

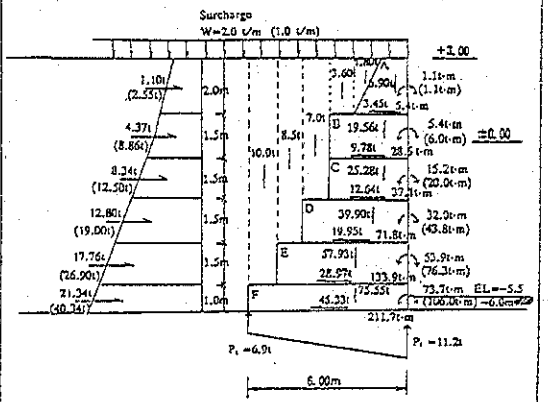
overturn Mpa + Mr = 7.5t·m
SF=Mpp/(Mpa+Mr)=(12.0/7.5)=1.6>1.2

Seismic Condition

sliding Pa + R = 15.9t
SF=Pp/(Pa+Pw)=27.0/15.9=1.7>1.2

overturn Mpa + Mr = 10.4t·m
SF=Mpp/(Mpa+Mr)=(12.5/10.4)=1.2>1.1

Concrete Block



( )shows the value under seismic condition

Stability of Concrete Block

Block	Condition	Sliding ※1	Overturn ※2
A	Ordinary	3.45 / 1.10 = 3.1 > 1.2	5.4 / 1.1 = 4.9 > 1.2
	Seisnic	3.45 / 2.55 = 1.4 > 1.0	5.4 / 1.1 = 4.9 > 1.1
B	Ordinary	9.78 / 4.37 = 2.3 > 1.2	28.5 / 5.4 = 5.3 > 1.2
	Seisnic	9.78 / 8.86 = 1.1 > 1.0	28.5 / 6.0 = 4.8 > 1.1
C	Ordinary	12.64 / 8.34 = 1.5 > 1.2	37.1 / 15.2 = 2.4 > 1.2
	Seisnic	12.64 / 12.50 = 1.0 > 1.0	37.1 / 20.0 = 1.9 > 1.1
D	Ordinary	19.95 / 12.80 = 1.6 > 1.2	71.8 / 32.0 = 2.2 > 1.2
	Seisnic	19.95 / 19.00 = 1.1 > 1.0	71.8 / 43.8 = 1.6 > 1.1
E	Ordinary	28.97 / 17.76 = 1.6 > 1.2	133.8 / 53.9 = 2.5 > 1.2
	Seisnic	28.97 / 26.90 = 1.1 > 1.0	133.8 / 76.3 = 1.8 > 1.1
F	Ordinary	45.33 / 21.34 = 2.1 > 1.2	211.7 / 73.7 = 2.9 > 1.2
	Seisnic	45.33 / 30.30 = 1.2 > 1.0	211.7 / 108.0 = 2.0 > 1.1

※1 SF = ΣW / P Μ = 0.5 (for block A)
Μ = 0.5 (for block B,C,D,E,F)

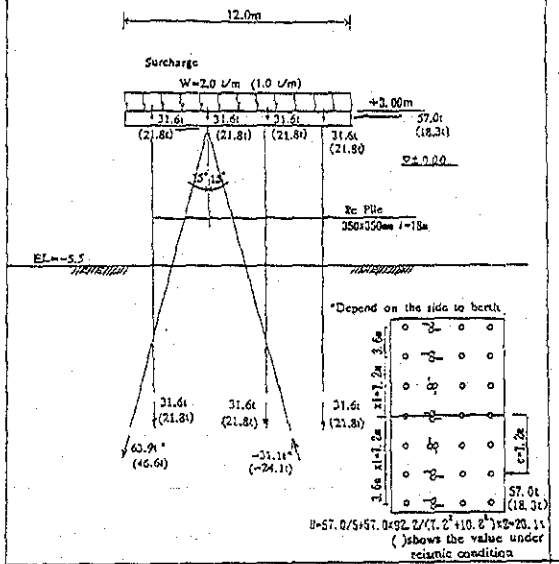
※2 SF = Mr / Mt

End reaction = 11.2t < 40t

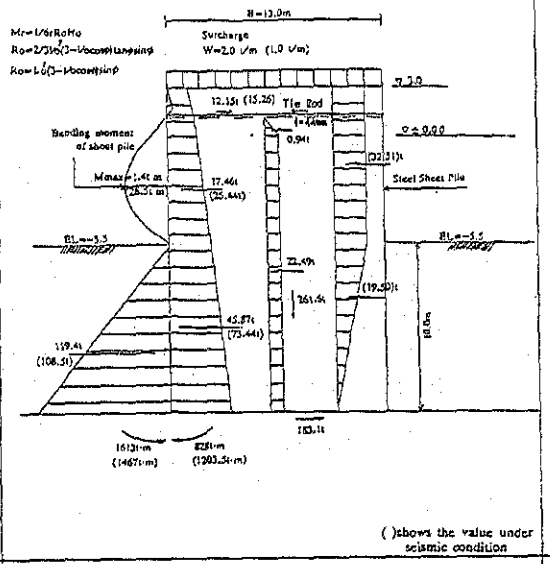
Source: JICA Study Team

Table 8-3(2) Result on Design Calculation (Bacolod)

Pier with Concrete Pile



Steel Sheet Pile Wall



Stability of Pier

For coupled batter Pile

	Ordinary Condition	Seismic Condition
Pushing Force	63.3t	46.6t
Ru	Ru = 30ApN + ΣAs/5 = 289 t	
SF	4.5 > 2.5	6.1 > 2.0
Pulling Force	31.1t	24.1t
Ru	Ru = ΣAs/5 = 105 t	
SF	3.4 > 3.0	2.6 > 2.5

Compressive Stress of pile

i) Vertical Pile 25.8 kg/cm2 < 70 kg/cm2
ii) Batter Pile 52.2 kg/cm2 < 70 kg/cm2

Stress on RC Beam

Maximum Moment 9.0t m
σ = M / Z = 1350 kg/cm2 < 1800 kg

Determination of Width

Ordinary Condition
B = 13.0 m FS = Mr / Md = 112 / 89 = 1.26 > 1.2

Seismic Condition FS = Mr / Md = 315 / 123 = 2.56 > 1.2

Stability of Sheet Pile

Ordinary Condition

MPa = 82.8t m MPp = 161.2t m SF = MPp / MPa = 1.95 > 1.5

Seismic Condition

MPa = 120.4t m MPp = 146.7t m SF = MPp / MPa = 1.22 > 1.2

Ordinary Condition

Sliding = ΣW / P = 1309.5 / 85.82 = 15.26 > 1.2
Overturning = Mr / Mt = 1819 / 468 = 3.89 > 1.2

Seismic Condition

Sliding = ΣW / P = 291.62 / 178.38 = 1.68 > 1.0
Overturning = Mr / Mt = 2062 / 1248 = 1.65 > 1.0

Stress of Sheet Pile

Maximum Moment = 21.43 t m (ordinary condition)
σ = M / Z = 964 kg/cm2 < 1800 kg/cm2

Maximum Moment = 28.48 t m (seismic condtion)
σ = M / Z = 1254.7 t m < 2700 kg/cm2

Tie Rod Reaction

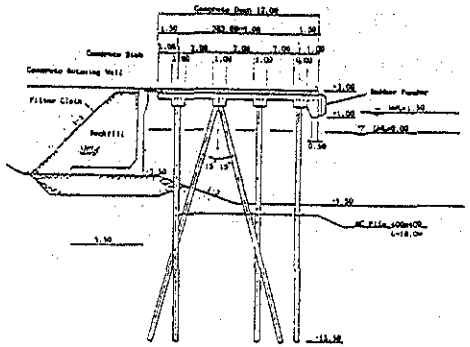
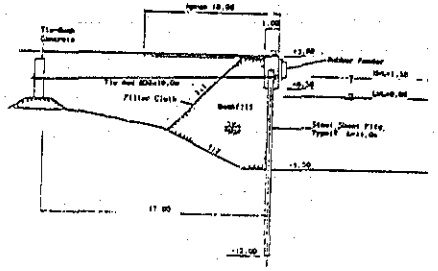
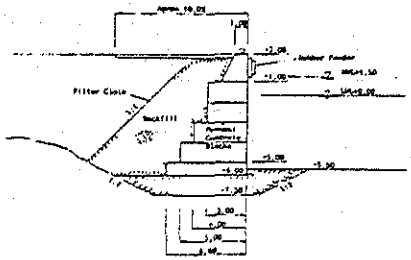
ordinary condition 12.15t Asreq = 12150 / 880 = 13.8 cm2
seismic condition 15.26t Asreq = 15260 / 1320 = 11.6 cm2

Use Tie Rod 4.40 cm diam (Considering the corrosion)
As =15.21 cm2

Source: JICA Study Team

Table 8-4(1) COMPARATIVE STUDY ON STRUCTURE ON RO/RO FERRY BERTH

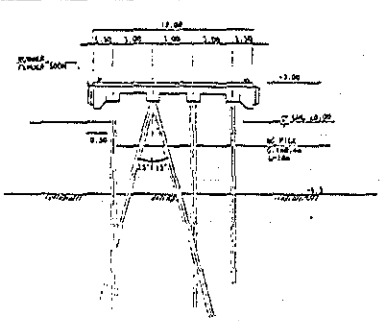
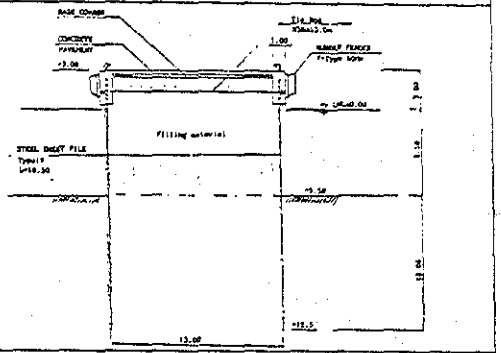
ILOILO

ITEMS \ TYPE	PIER WITH CONCRETE PILE	TIE-BACK WALL W/ SHEET PILE	CONCRETE BLOCK
STANDARD SECTION			
AVAILABILITY OF MATERIAL	ALL MATERIAL IS AVAILABLE LOCALLY	STELL SHEET PILE AND TIE RODS SHALL BE IMPORTED. OTHER MATERIAL RELATING TO CONCRETE WORK IS AVAILABLE LOCALLY	ALL MATERIAL IS AVAILABLE LOCALLY
CONSTRUCTION EQUIPMENT	25t CRANE IS NEEDED FOR INSTALLATION OF L-SHAPED BLOCK AND RC PILE DRIVING 400 GRT BERGE WILL ALSO BE NEEDED	25t CRANE IS NEEDED FOR SHEET PILE DRIVING 400 GRT BERGE WILL ALSO BE NEEDED	75t CRANE IS NEEDED FOR SHEET PILE DRIVING 600 GRT BERGE WILL ALSO BE NEEDED
CONSTRUCTION PERIOD	LONGEST CONSTRUCTION PERIOD SHALL BE THAN OTHER STRUCTURES.	CONSTRUCTION PERIOD WILL BE SHORTEST AMONG THREE STRUCTURES	LONGER CONSTRUCTION PERIOD WILL BE NEEDED THAN TIE-BACK STRUCTURE BUT SORTER THAN RC PIER TYPE STRUCTURE.
COST COMPARISON	1.00	1.04	1.17
RECOMMENDATION	MOST RECOMMENDED		

Source: JICA Study Team

Table 8-4(2) COMPARATIVE STUDY ON STRUCTURE ON RO/RO FERRY BERTH

BACOLOD

ITEMS \ TYPE	PIER WITH CONCRETE PILE	DOUBLE WALL W/SHEET PILE
STANDARD SECTION		
AVAILABILITY OF MATERIAL	ALL MATERIAL IS AVAILABLE LOCALLY	STELL SHEET PILE AND TIE RODS SHALL BE IMPORTED. OTHER MATERIAL RELATING TO CONCRETE WORK IS AVAILABLE LOCALLY
CONSTRUCTION EQUIPMENT	25t CRANE IS NEEDED FOR RC PILE DRIVING 400 GRT BERGE WILL ALSO BE NEEDED	25t CRANE IS NEEDED FOR SHEET PILE DRIVING 400 GRT BERGE WILL ALSO BE NEEDED
CONSTRUCTION PERIOD	SHORTER CONSTRUCTION PERIOD THAN DOUBLE WALL.	LONGER CONSTRUCTION PERIOD WILL BE NEEDED
COST COMPARISON	1.00	1.94
RECOMMENDATION	MOST RECOMMENDED	

Source: JICA Study Team

[References]

1. Technical Standard for Ports and Harbors Facilities, Japan, 1980

2. National Structural Code of the Philippines, Association of Structural Engineering of the Philippines, 1987

Chapter 9 Cost Estimation and Construction Schedule

A. Cost Estimate

1. Unit price of major construction items such as reinforced concrete (RC) structure, RC pile, rock (armour rock, rubble stone, hearting rock and base coarse), reclamation filling, dredging, building works and utility work are estimated inclusive of material cost and installation cost based on the data collected from DPWH regional office in Bacolod, PMO PPA in Iloilo and other government agencies in July 1991. Typical unit price are shown in Table 9-1. Detail breakdown of unit price is shown in Note A-2-9-1 in Appendices.

2. Material source for major construction material such as sand, gravel, bolder and armour rockis shown in Figure 9-1 and Table 9-2. In the case of Bacolod, armour rock shall be carried from Guimaras Island due to the lack of quarry site of near Bacolod city.

Table 9-1 Unit Price of Construction Item

Item	Unit	Unit Price (pesos)
Armour Rock	cu.m	450 - 650
Core Material	cu.m	318 - 450
Base Coarse	cu.m	222
Filter Material	sq.m	450 - 500
Structural Concrete	cu.m	5,340
Reinforcement Bar	kg	26 - 30
RC Pile (35cmx35cm) including Driving	m	3,500
Concrete Curb	m	1,500 - 1,600
Concrete Pavement	sq.m	645 - 710
Dredging	cu.m	100
Reclamation	cu.m	100
Granular Fill	cu.m	265
RC Building (Terminal Building)	sq.m	11,000
Parking Space	sq.m	700
Water Supply	m	1,000
Electricity Supply	m	1,000
Rubber Fender	set	70,000
Mooring Bitt	set	40,000

Source: JICA Study Team

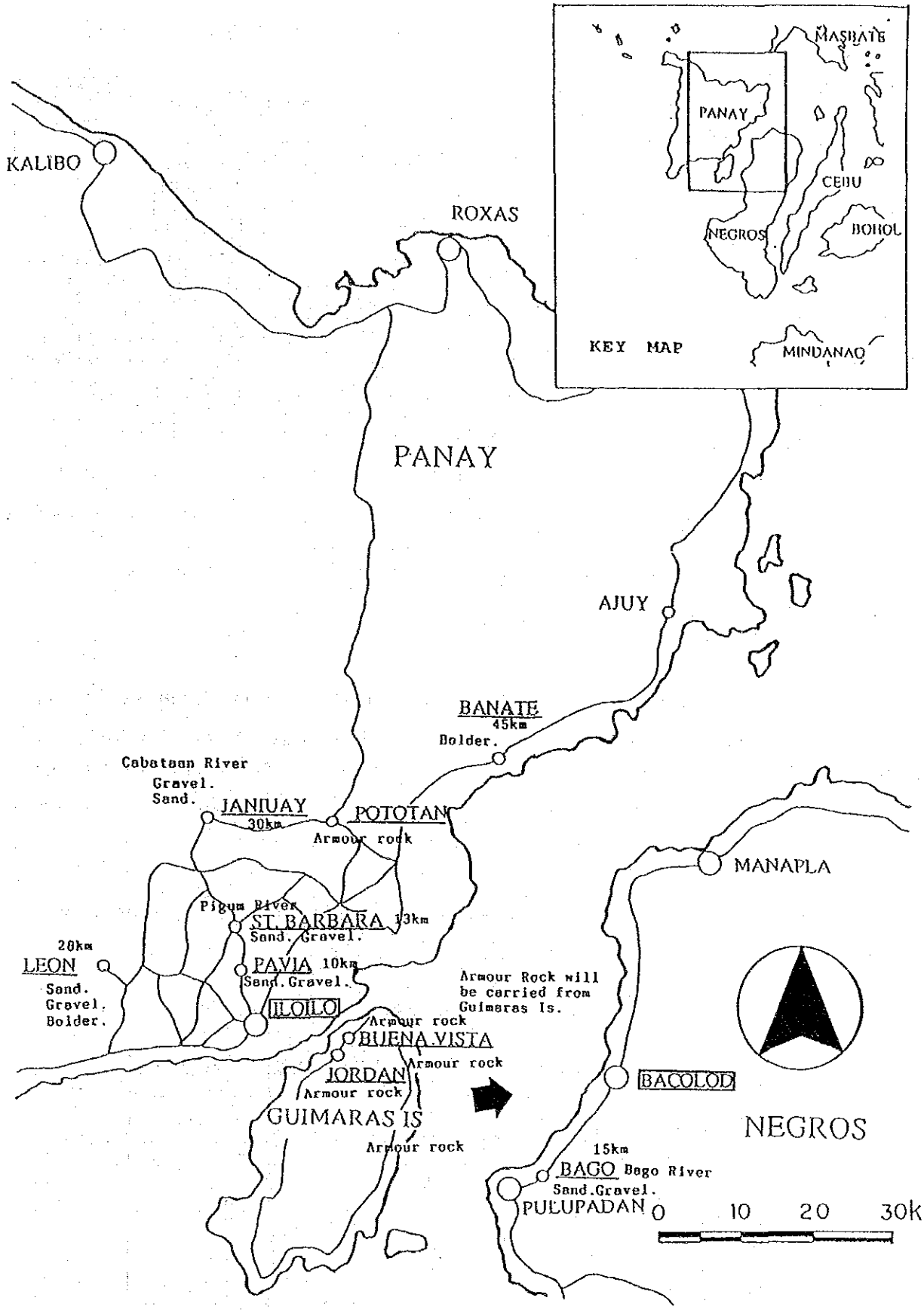


Figure 9-1 Material Source Map
Source: JICA Study Team

Table 9-2 List of Construction Material Sources

Project Site	Name of Place	Distance	Quarry Site	Material	Quantity	Quarity	Remark
Iloilo	Banate	45km	field	Bolder	2.5㎢	Hard rock	
	Janiuay	30km	Cabataan River	Sand	-	River sand	
				Gravel	3.0km	Hard rock	
	Pototan	30km	field	Armour rock	1.5㎢	Light/Soft	
	Leon	28km	field	Sand	3.0㎢	River sand	
				Gravel	-	Hard rock	
				Bolder	-	Hard rock	
	Sta.Barbara	13km	Pigum River	Sand	-	River sand	
				Gravel	1.5km	Hard rock	*Guimaras Island
	Pavia	10km	field	Sand	1.0㎢	River sand	is also material
				Gravel	-	Hard rock	source of rock
(Guimaras Is.)	Jordan	1.5km	Mountain	Armour rock	600㎢	Hard rock	such as gravel
(Guimaras Is.)	Buena Vista	1.5km	Mountain	Armour rock	600㎢	Hard rock	and rubble stone
Bacolod	Bago	15km	Bago River	Sand	10km	Hard rock	*Bago was major
				Gravel	-	River sand	material source
(Guimaras Is.)	Jordan	30km	Mountain	Armour rock	600㎢	Hard rock	for construction
(Guimaras Is.)	Buena Vista	30km	Mountain	Armour rock	600㎢	Hard rock	of Pulupandan
(Guimaras Is.)	east coast	15km	Mountain	Armour rock	600㎢	Hard rock	port

* Material for reclamation fill in Iloilo shall be obtained from Oton Bank which is located in front of Project site.
* Material for reclamation fill in Bacolod shall be obtained from existing sand beach adjacent to the Project site.
* Sand material listed above shall be used for concrete.
* Quantity is specified by length or area due to the lack of data about depth.

Source; JICA Study Team

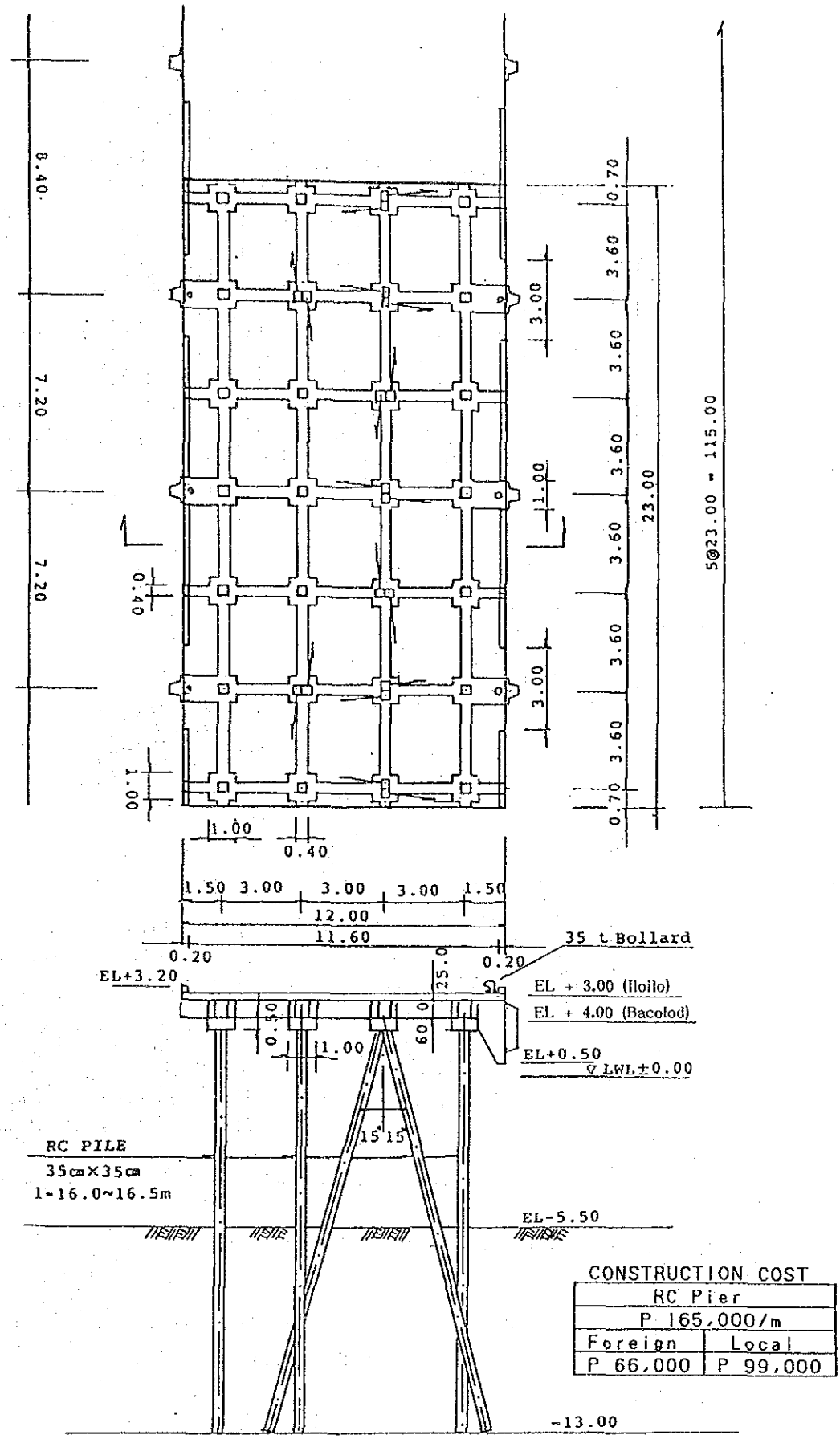
3. Ro/Ro Ferry terminal is composed of various structure such as RC pier, RC fixed ramp, RC trestle, rock causeway, revetment, L- shaped retaining wall, terminal building and utilities, which are shown in Figure-9-2 to Figure-9-12 with the construction cost. DPWH standard was applied in the design of the thickness of concrete and base coarse for the pavement or roadway.

4. In the calculation of construction cost, share of the foreign currency and local currency are applied at following rate.

Table 9-3 Share of Foreign and Local Currency

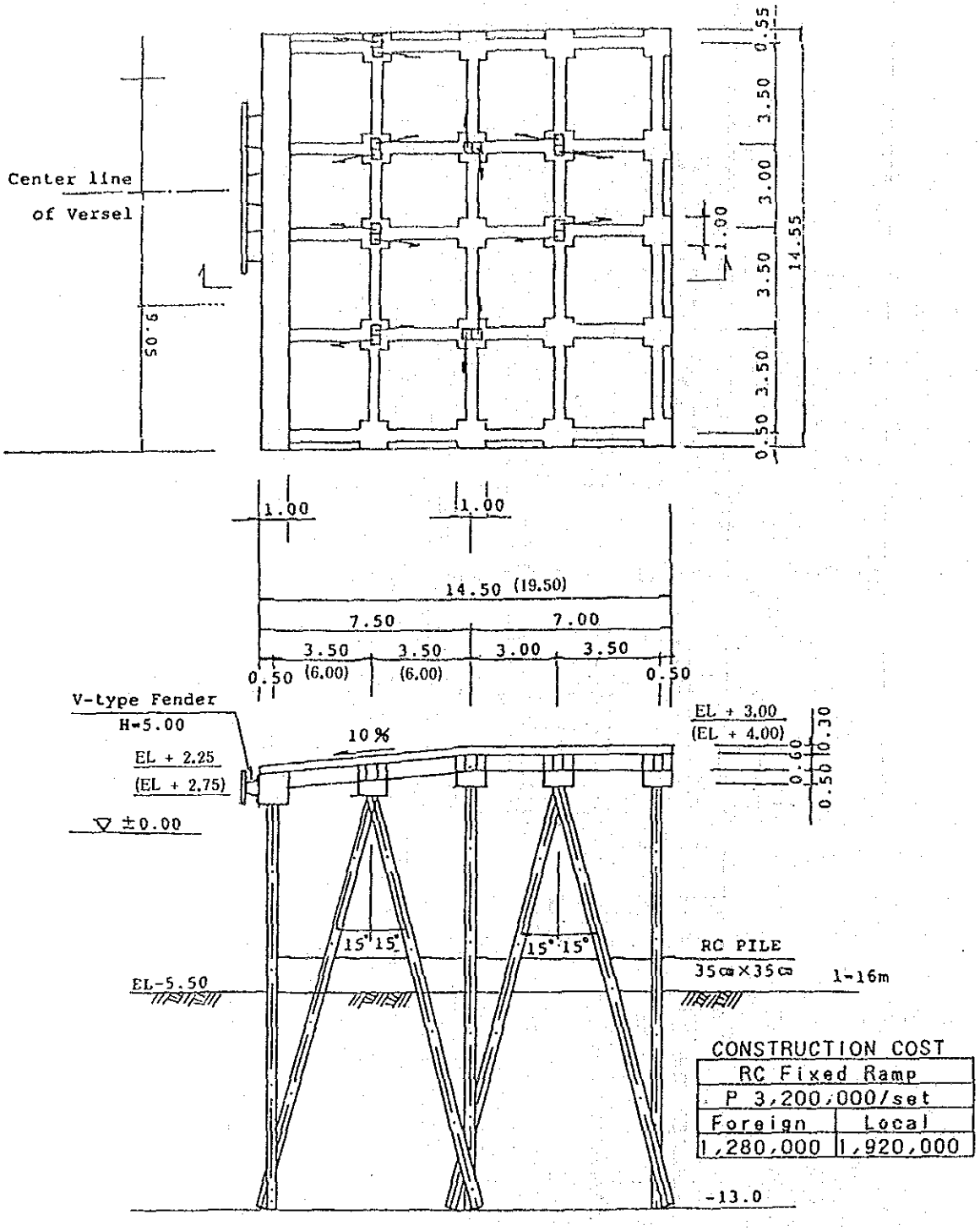
Item	Foreign Portion	:	Local Portion
Berthing Pier	4	:	6
Ro/Ro Ramp	4	:	6
L-shaped Revetment	3.5	:	6.5
Pavement	3.5	:	6.5
Reclamation	3	:	7
Turning Area	4	:	6
Dredging	3	:	7
Building	3	:	7
Trestle	4	:	6
Rock Causeway	3	:	7
Revetment	3	:	7
Utility	3.5	:	6.5

Source: JICA Study Team



CONSTRUCTION COST	
RC Pier	
P 165,000/m	
Foreign	Local
P 66,000	P 99,000

Figure 9-2 Standard Section of RC Pier
Source: JICA Study Team



Note: ( ) Shows the dimension for Bacolod

Figure 9-3 Standard Section of RC Fixed Ramp

Source: JICA Study Team

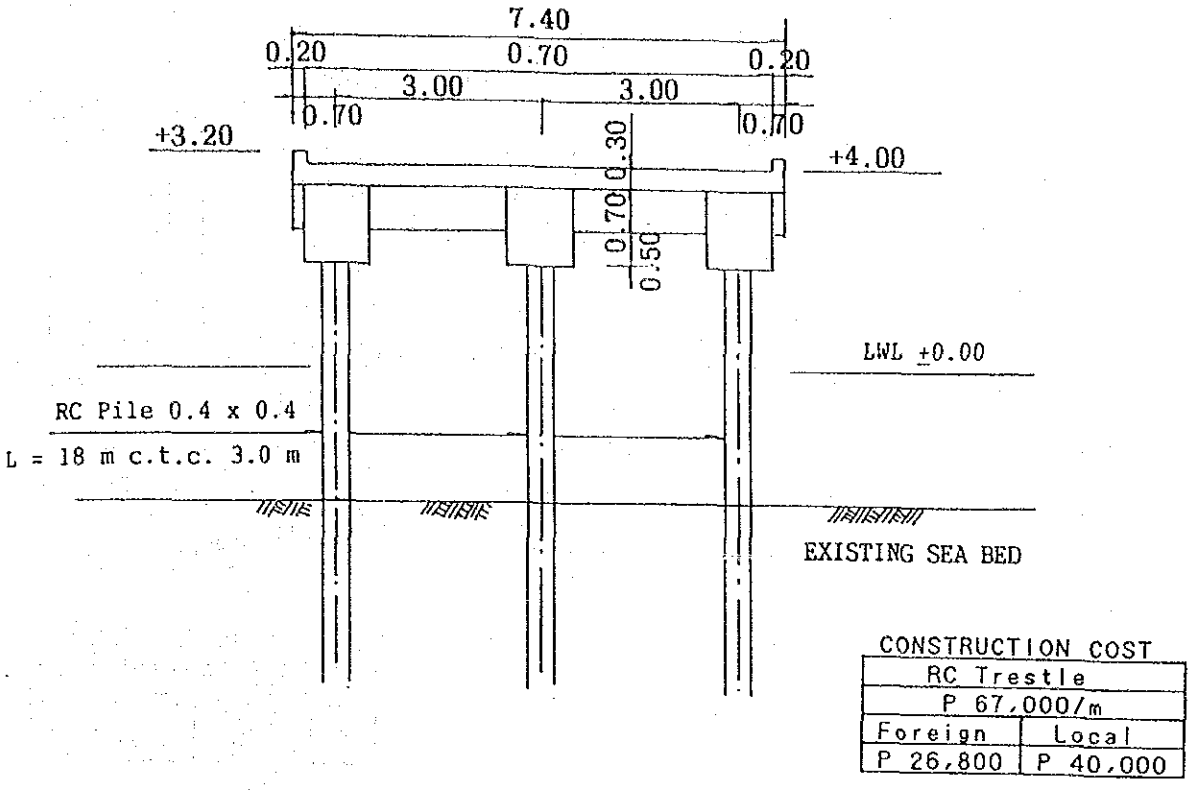


Figure 9-4 Standard Section of RC Trestle (Bacolod)
Source: JICA Study Team

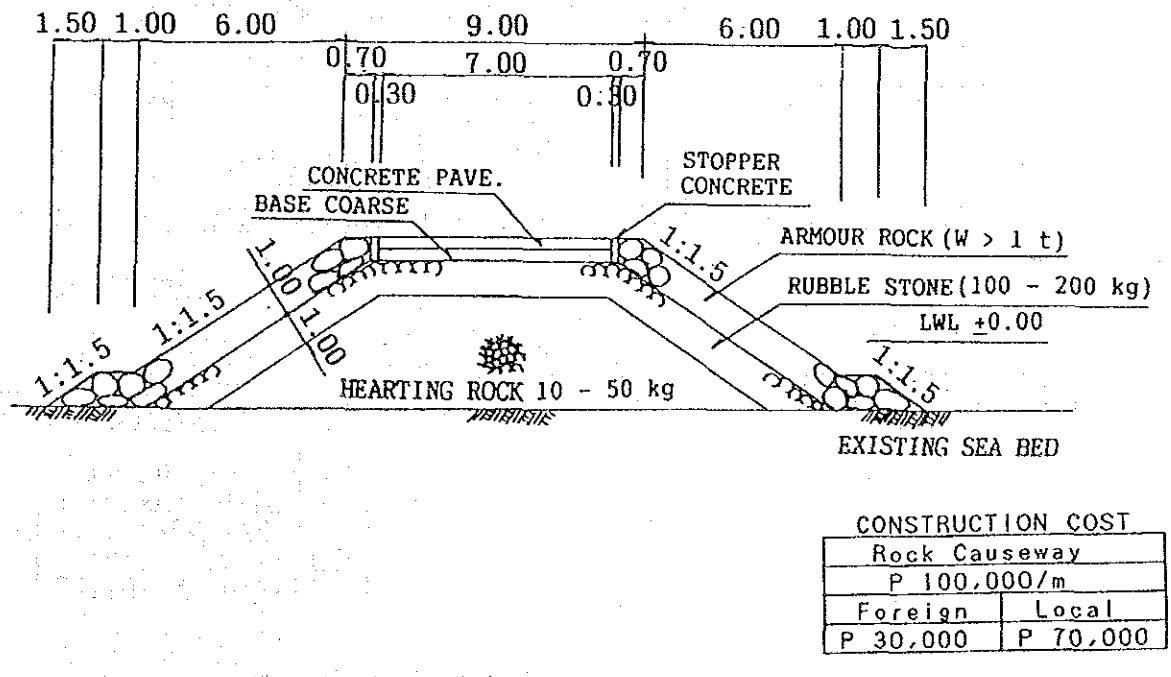


Figure 9-5 Standard Section of Rock Causeway
Source: JICA Study Team