6.3 Cargo-volume Forecast of Private Ports Along Batangas Bay

6.3.1 Private ports and commodities to be considered

All the existing private ports along Batangas Bay except the AG & P Pole Creosoting Plant are considered in the cargo-volume projections. The AG & P Pole Creosoting Plant is omitted because the company has already stopped operations and no cargo is expected to be handled there in the future.

Cargo volumes of the commodities handled in the said private ports are forecast in this section. However, sugar is excluded. This is because the government has taken over the sugar business, and sugar is not expected to be handled at the private ports in the near future.

In addition to the presently located ports, the forecast also considers private ports which are expected to open within the next five years or so. The additional private ports are identified in the next section, 6.3.2.

6.3.2 Additional Private Ports Along Batangas Bay

Despite the great potential of Batangas Bay for industrial development, it is difficult to identify other private ports which will be established in the area within the next five years or so. According to an interview with an office of the NEDA National Industrial Estate Program, the government has no immediate policy/program to promote industrial development in the Batangas Area.

Nevertheless, there are two additional private ports which are expected to begin operations along Batangas Bay. They are the Atlantic Gulf and Pacific Co. of Manila – Batangas Marine and Fabrication Yard (AG&P-BMFY), and the National Coal Authority (NCA) permanent coal terminal. The two companies are likely to begin operations in 1985 and 1986, respectively (Table 6.3.1).

(1) Atlantic Gulf and Pacific Co. of Manila – Batangas Marine Fabrication Yard (AG&P-BMFY)

AG&P-BMFY has a plan to construct a steel fabrication yard at San Andres, Bauan, Batangas, just between PNOC Marine Co. and Bauan municipal port.

The facility will produce steel products for off-shore oil structures (export), drilling equipment (export), steel frameworks for industrial plants and high-rise buildings (domestic) and other heavy structural steel frameworks.

Raw materials will consist of local and imported steel. Said materials will be transported by sea from Iligan (for local steel) and Manila (for imported materials). The mixture of the material input for steel manufacturing will depend on the type of structures and the needs of the end users. But for finished products for export such as offshore oil structures and drilling equipment, about 40 ~ 50 percent of all the raw materials will be imported.

All the finished materials for exports (100 percent) will be handled at the pier. On the other hand, about 50 percent of the finished products for domestic consumption will pass through the pier and the rest will be moved by land.

The company is projected to produce approximately 45,000 M.T. of finished products in 1990. About 40 ~ 50 percent of those will be for export.

(2) National Coal Authority (NCA) Permanent Coal Terminal

In continuation of the NCA's nationwide coal distribution program, the company has a plan to construct a permanent coal terminal (loading/unloading and blending facilities) at Sta. Rita, Batangas City, some 5 km away from its present interim facility at Bauan, Batangas (in PMC's compound).

The terminal will serve as a distribution point for the 11 cement plants located on Luzon Island. (Fig. 6.3.1).

According to an interview with Coal Authority representatives, the permanent facility will have a handling capacity of 2.3 million M.T. of coal per year and a blending rate of 500 M.T. per hour. The company will handle both imported and local coal. Imported coal will come from Australia, China and Canada, while local coal will come from sothern parts of the country such as Cebu. The blending or mixture of imported and domestic coal depends on user needs, the availability of coal and government priorities. However, according to an interview with the Philippine Cement Authority, cement plants consume approximately 80 percent of total national coal imports.

About 80 percent of the blended coal prepared at NCA's terminal will be transported to the nine (9) cement plants located in Balacan, Rizal and Batangas by coal haulers. The rest will be transhipped to NCA Poro terminal in San Fernando, La Union to supply the cement plants of Northern and Bacnotan. The terminal is projected to handle 500,000 ~ 1,000,000 M.T. of coal for cement plants in 1990.

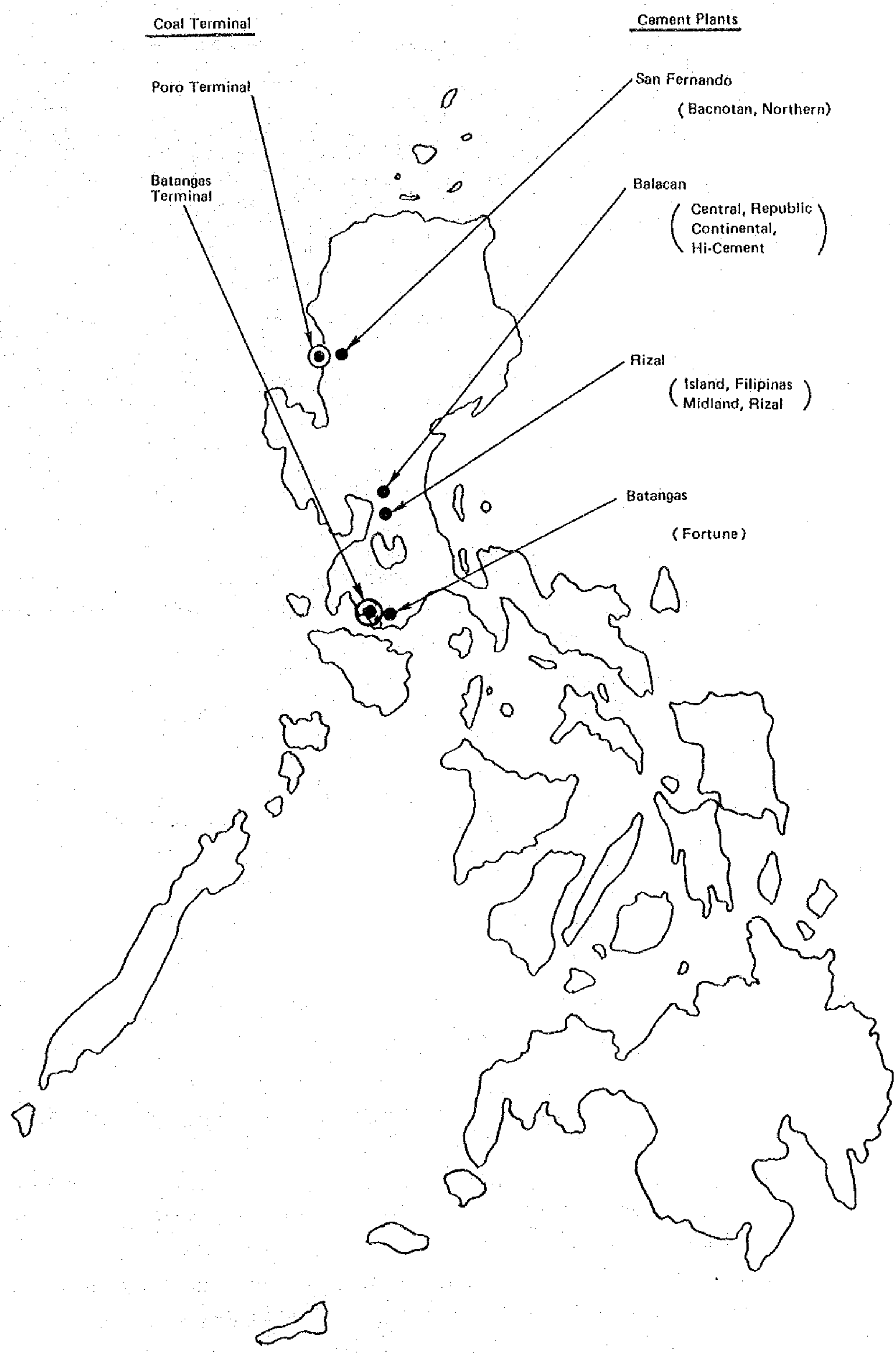


Fig. 6.3.1 Location of Batangas Terminal, Poro Terminal and Cement Plants on Luzon Island

Table 6.3.1 Additional Private Ports Along Batangas Bay

Owner's Name	Location	Type of Industry or Activity	Year to Start Operation	Expected Cargo Volume in 1990 (M.T.)	Planed Land Area (HA)
Atlantic Gulf & Pacific Co., of Manila, Batangas Marine and Fabrication Yard	Barrio San Andres, Bauan,	Steel products Fabrication	1985	Approximately 70,000 ~ 80,000	67
National Coal Authority	Sta. Rita, Batangas City	Coal blending/ Supply	1986	Approximately 0.5 ~ 1 mil.	29

6.3.3 Projections of Cargo Volume of Private Ports

(1) Commodity Groupings for the Cargo Volume Projections

For convenience, the projections of cargo volume of the private ports along Batangas Bay are made on the basis of the following commodity groupings:

a) Crude oil and petroleum products related to oil refining
b) Grains and their products
c) Coconut oil and coconut chemicals related to production at UNICHEM
d) Coal
e) Imported chemicals
f) Exported coconut products (from BBTI)
g) Steel and steel products (from AG&P-BMFY)
h) Others

(2) Methodology and Cargo Projections

1) Crude Oil and Petroleum Products Related to Oil Refining

i) Assume national petroleum products consumption in 1990 and 2000. (Appendix 6.3.1).

ii) Assume the percent of national consumption which will be supplied by production at Batangas in 1990 and 2000. (Appendix 6.3.3).

iii) Estimate the future volume of petroleum products for domestic use in 1990 and 2000 produced at Batangas, based on the assumption in steps i) and ii). (Appendix 6.3.5).

iv) Assume the ratio of petroleum product exports to petroleum product supply for domestic use at the Batangas Oil Refineries. (Appendix 6.3.6).

v) Estimate the petroleum products export volume of Batangas oil refineries in 1990 and 2000, based on the assumptions in steps iii) and iv). (Appendix 6.3.7).

vi) Estimate the total incoming cargo volume into the Batangas oil refineries in 1990 and 2000 based on the assumptions in steps iii) and v). Here, the total incoming cargo volume is assumed equal to the output, that is the sum total of exports from the refineries and production from the refineries for domestic use. This calculation does not take into account refining loss and fuel used by the refineries themselves. Also, as the export of crude oil is insignificant, crude export figures are not considered when making these projections. (Appendix 6.3.8).

vii) Assume the distribution of crude oil and petroleum products in incoming cargo at the Batangas oil refineries (Appendix 6.3.9).

viii) Estimate the incoming volumes of crude oil and petroleum products in domestic/foreign trade in 1990 and 2000, based on the assumptions in steps vi) and vii). (Appendix 6.3.10).

ix) Assume the ratio of outgoing petroleum product volume for domestic use to petroleum product supply volume for domestic use at the Batangas oil refineries. "Outgoing petroleum product volume for domestic use" stands for the volume of the products which are or will be distributed to other areas of the country by sea. (Appendix 6.3.11).

x) Estimate the outgoing petroleum product volume for domestic use, based on the assumptions in steps iii) and ix). Outgoing crude oil is neglected here. (Appendix 6.3.12).

2) Grains and Grain Products

i) Importation of wheat and soybeans
- Estimate the imports of the Philippines in 1990 and 2000 on the basis of historical trends.
- Assume the percentage of total imports that will come through Batangas.
- Estimate cargo volume in 1990 and 2000 using the assumed percentage. (Appendix 6.3.14 and 15).

ii) Outgoing flour
- Assume the ratio of outgoing flour to imported wheat.
- Estimate the volume of outgoing flour based on the volume of projected wheat imports and the ratio assumed in the previous step. (Appendix 6.3.16).

iii) Palay/Rice (from Mindoro)
- Estimate the palay/rice surplus in Mindoro in 1990 and 2000.
- Assume the share of the palay/rice which goes from Mindoro to the NFA terminal.
- Assume the mixture of palay and rice.
- Estimate the cargo volume of palay/rice in 1990 and 2000. (Appendix 6.3.17).

iv) Other cereals (from Mindoro and other islands)
- Assume the ratio of the volume of other cereals to that of palay/rice. (Appendix 6.3.17).

- Estimate the volume of other cereals, based on the projected volume of palay/rice and the assumed ratio. (Appendix 6.3.17).

3) Coconut Oil and Coconut Chemicals Related to Production at UNICHEM

   i) Assume annual input volume of crude coconut oil and annual output volume of coconut chemicals at full operation. (Appendix 6.3.19).

   ii) Assume the operating ratio in 1990 and 2000.

   iii) Estimate the cargo volumes of crude coconut oil and coconut chemicals. (Appendix 6.3.20).

4) Coal

   i) Assume coal requirements for the Philippine cement industry in 1990 and 2000.

   ii) Estimate the domestically purchased and imported coal volumes for the Philippine cement industry. (Appendix 6.3.21).

   iii) Assume the production shares of the Philippine cement plants. (Appendix 6.3.25).

   iv) Estimate incoming coal volume using the domestically purchased coal volume which is determined in step ii) and the production share of Luzon-based cement plants which is assumed in step iii).

   v) Likewise, estimate outgoing coal volume using the total coal demand of the Philippine cement industry and the production share of Bacnotan and Northern cement.

   vi) Estimate imported coal volume at Batangas using the total imported coal volume for Philippine cement production and the production share of Luzon-based cement plants. (Appendix 6.3.26).

5) Imported Chemicals

   i) Estimate Philippine import volumes in 1990 and 2000 based on the historical trend of correlation between GNP and Philippine's total imports.

   ii) Assume the share of BBTI and Himmel to the Philippine total.

   iii) Estimate import volume of BBTI and Himmel in 1990 and 2000 on the basis of the assumptions in steps i) and ii). (Appendix 6.3.27).

6) Exported Coconut Products (from BBTI)

   i) Estimate Philippine export volumes of coconut oil in 1990 and 2000 on the basis of the historical trend.

   ii) Assume BBTI's share to the Philippine total.

   iii) Estimate BBTI's export volumes of coconut oil in 1990 and 2000 based on the assumptions in steps i) and ii). (Appendix 6.3.28).

   iv) Estimate BBTI's export volumes of copra cake/meal in 1990 and 2000 in the same way as the coconut oil projection. (Appendix 6.3.29).

7) Steel and Steel Products (from AG&P-BMFY)

i) Assume volumes of finished fabricated steel products in 1990 and 2000.

ii) Assume the percentage of finished products in 1990 and 2000 which will be exported. (100 percent of exported products is supposed to pass through the private port).

iii) Assume the share of the finished products which are domestically shipped by sea in 1990 and 2000.

iv) Estimate the port cargo volume of exported and domestically shipped products in 1990 and 2000.

v) Estimate the volume of raw steel materials coming in through the private port in 1990 and 2000 based on the assumptions in step i). (Appendix 6.3.30).

8) Others

i) Estimate the total cargo volume in 1990 and 2000 based on the historical trend of correlation between GDP and the cargo volume. (Appendix 6.3.32).

ii) Estimate cargo volume of domestic and foreign trade in 1990 and 2000 based on the average cargo volume distribution of domestic and foreign trade for the period 1979 ~ 1983. (Appendix 6.3.33).

(3) Rough Estimate of Cargo Volume Handled by Private Ports along Batangas Bay in 1990 and 2000.

Table 6.3.2 shows the rough estimate of cargo volumes which will be handled by the private ports along Batangas Bay in 1990 and 2000. According to Table 6.3.2, said private ports will handle approximately 8.0 million tons in 1990 and 10.4 million tons in 2000.

Table 6.3.2 Rough Estimate of Cargo Volume Handled by Private Ports along Batangas Bay in 1990 and 2000*1,*2

(Unit: thousand tons)

Commodity	1990	2000
Crude Oil and Petroleum Products related to Oil Refining	6,481 (4,461)	8,169 (5,581)
Grain	177 (140)	255 (203)
Coconut Oil and Coco-chemical Products (UNICHEM)	136 (37)	136 (37)
Coal	885 (336)	1,446 (280)
Chemicals (Import)	51 (51)	77 (77)
Coconut Products (Export)	66 (66)	83 (83)
Steel and Steel Products (AG & P-BMFY)	79 (23)	88 (25)
Other Commodities	165 (42)	191 (49)
Total	8,040 (5,156)	10,445 (6,335)

Note: *1 Figures without parentheses stand for the projected total cargo volume of each commodity, and those in parenthesis are the projected cargo volume of foreign trade in the total volume.

*2 The cargo forecast in the year 2000 is based on "Case II" of the socio-economic frame assumed in Section 6.1.3.

CHAPTER 7
PORT PLANNING

CHAPTER 7 PORT PLANNING

This chapter deals with determining the scale of the facilities for the Master Plan in 2000 in accordance with the basic concepts for port development and the forecast cargo volume at Batangas Port. Within the framework of the Master Plan, the facilities urgently required up to 1990 are formulated as the Short-term Development Plan.

7.1 Strategic Considerations in the Formulation of the Master Plan

The strategy in planning Batangas Port is as follows:

(1) To emphasize the construction of the Ro-Ro and Ferry wharf in the Short-term and Master Plans. Not only ship berthing facilities, but also various accommodations for passengers and cars such as the passenger terminal and parking lot will become necessary for both cargo handling and amenity requirements;

(2) To utilize the highly advantageous natural conditions surrounding Batangas Port. In order to make full use of these natural advantages such as deep and calm waters, a new wharf that can accommodate larger vessels should be developed,

(3) To also make full use of strategic location of Batangas: its proximity to the Metro Manila area. To utilize this advantage, the ample room behind the present port area should be developed as a steel products distribution terminal and related industrial complex,

(4) To make the most of the existing port facilities, especially Piers I, II, and III and the marginal wharf which extends from Pier II, and

(5) To make the plan in line with the Coastal Zone Use Concept.

7.2 The Scale of the Master Plan

The Master Plan must be designed so that the facilities can accommodate the estimated traffic demand in the year 2000. According to the cargo forecast, the total annual cargo volume at Batangas Port will be 3.06 million tons in the year 2000, of which 1.1 million tons is Ro-Ro and Ferry cargo, 578 thousand tons is foreign trade, and 1.39 million tons is domestic trade as shown in Table 7.2.1.

Table 7.2.1 Estimated Cargo Volume at Batangas Port in the Year 2000

('000 tons)

Trade		2000		
		Unloading	Loading	Total
Ro-Ro & Ferry	Route 1	530	377	907
	Route 2	87	103	190
Foriegn Trade		410	168	578
Domestic Trade		1,342	46	1,388
Total		2,369	694	3,063

7.2.1 Ro-Ro and Ferry Wharf

Among the services which will be provided at Batangas Port, Ro-Ro vessel services will very likely continue to play an important role, especially in the development of Mindoro Island. After the opening of Ro-Ro vessel services between Batangas and Calapan in 1981, about 60 percent of the cargo shipped to and from Mindoro has moved to the Ro-Ro sector. Based on the forecast cargo demand for Ro-Ro vessels, the requirement for Ro-Ro facilities will greatly increase.

At present, Ro-Ro vessels dock at pier type wharves which could not meet future increases in ship size. These piers are also utilized by cargo vessels at the same time.

As the number of Ro-Ro services increases, such dual utilization of these wharves will cause confusion. Furthermore, passengers may be endangered on the narrow pier deck. In order to attain efficient and safe port operation, a comprehensive port plan for the Ro-Ro wharf becomes particularly significant.

The main conditions affecting the design of the Ro-Ro and ferry wharf are listed below. All of these conditions are for the year 2000.

1) The cargo volume carried by Ro-Ro type vessels will be 907,000 tons for the Calapan-Batangas route (of which 530,000 tons are inward cargo), and 190,000 tons for the new Occidental Mindoro route.

2) The estimated number of passengers is 2,010,000 for the Calapan route, 960,000 for the Abra de Ilog route, and 80,000 for Puerto Galera.

3) The ship size is assumed to be 700 GT and the maximum loading capacity 440 tons, or 30 vehicles including trucks and jeepnies. (Refer to Appendix 7.2)

4) Assuming that the ratio of actual cargo load to maximum loading capacity will be 60%, the average cargo volume per ship will be 265 tons. (Refer also to Appendix 7.2)

5) The legal passenger limit is 400 for Ro-Ro vessels and 300 for ferry boats.

6) Ro-Ro vessels and ferry boats will continue to be operated by the two shipping companies which presently operate the Batangas-Calapan shipping route.

7) The number of ship working days per year is 350.

The Ro-Ro and ferry wharf facilities including the number of berths, and the size and structure of the parking lot and passenger terminal are planned in accordance with the above conditions.

(1) Number of Berths

The number of berths required to accommodate the future cargo volume depends upon the number of port calls per day and the schedule of the port calls. Considering the cargo volume per ship, the minimum service to carry the projected future cargo is six calls per day. Considering the present shipping schedule, three Ro-Ro berths will be required for the Calapan-Batangas route. Additionally, judging from the cargo volume of the Occidental Mindoro route, one additional berth will be necessary for this route.

As for passenger transportation, the present number of ferry boats together with the Ro-Ro vessel services is enough to meet the future increase in the number of passengers. Four berths are required for ferry operations.

(2) Parking Lot

The parking lot area required for the Ro-Ro and ferry terminal is estimated using the following formula:

$$A = a \times n \times \alpha \times \beta$$

where, A : Parking area per berth (m^2)
a : Area required per vehicle (93 m^2)
n : Vehicle capacity for Ro-Ro type vessels (30)
α : Coefficient of utilization of area for both embarking and disembarking (1.0)
β : Coefficient of concentration (1.0)

Accordingly,

$$A = 93 \times 30 \times 1.0 \times 1.0 = 2{,}790 \text{ m}^2/\text{berth}$$

The area required for all the Ro-Ro berths totals approximately 11,000 m^2. In addition to this area for embarking and disembarking trucks and cars, a parking lot for public buses, jeepies and private cars used by passengers is required. As two Ro-Ro type vessels arrive at or about the same time, the requires area is estimated as follows:

$$A_p = \frac{2N_R}{N_B} \cdot \beta \cdot a$$

where, A_p : Parking area for public busses for passengers
N_R : Legal passenger limit per ship (400)
N_B : Legal passenger limit per bus (50)
β : Coefficient of concentration (1.2)
a : Area required per vehicle (93 m^2)

Accordingly,

$$A_p = \frac{2 \times 400}{50} \times 1.2 \times 93 \fallingdotseq 1{,}800 \text{ m}^2$$

As for the parking lot for ferry boat passengers, the required area is estimated to be about 1,300 m^2 using the same formula.

Therefore, the total parking lot area is aout 14,100 m^2.

(3) Passenger Terminal

The passenger terminal which provides various services for passengers is one of the indispensable facilities. The area required for the passenger terminal is estimated by the following formula:

$$A_t = a \times n \times N \times \alpha \times \beta$$

where, A_t : Area required for the passenger terminal (m^2)
a : Area required per person (1.2 m^2)
n : Legal passenger limit per ship (400 for Ro-Ro type vessels and 300 for ferries)
N : Number of ships starting simultaneously (2)
α : Peak ratio (1.0)
β : Coefficient of seasonal variation (1.2)

Accordingly, the area required for the passenger terminal in the year 2000 can be calculated as:

$$A_t = 1.2 \times 400 \times 2 \times 1.0 \times 1.2 = 1{,}152 \fallingdotseq 1{,}200 \text{ m}^2$$

The area for passengers embarking on ferry boats has been calculated to be about 800 m^2 using the same formula.

Thus, the total area for the passenger terminal is estimated to be 2,000 m^2.

(4) **Parks and Gardens**

In addition to the aforementioned main facilities, the arrangement of parks and gardens in the terminal area is important for the amenity of the wharf. About 20% of the total area of the Ro-Ro and ferry wharves should be used for green areas.

7.2.2 Foreign General Cargo Wharf

The following conditions are assumed for designing the foreign general cargo wharf:

1) The kinds of cargoes are cement, minerals, sugar, and some other general cargoes.
2) The cargo volume is 218,000 tons, of which 130 thousand tons are cement, 19 thousand tons are minerals and the remaining 69 thousand tons are other cargoes including sugar and chemicals.
3) The cargo handling rate is assumed to be 1,200 tons/m for bagged cement and 1,000 tons/m for all other commodities.
4) Ship size is considered to be 15,000 DWT based on the size of vessels calling at Batangas Port in the years 1981 and 1983. (Refer to Fig. 2.1.3)

Based on these premises, the number of berths, water depth of the quaywall, and the area of the transit shed and open storage area are determined as follows:

(1) **Number of Berths**

The number of berths is calculated using the cargo handling rate and cargo volume of each type of cargo.

The equivalent berth length is calculated as 177 m by summation of each necessary berth length by commodity. Again, taking into consideration the maximum ship size to be accommodated at this wharf, one berth with a berth length of 185 m and a water depth of −10 m is required.

(2) **Transit Shed**

The cargo which passes through the wharf can be devided into two categories: the cargo which is loaded/unloaded directly at shipside, and the cargo which passes through the transit shed.

Assuming that 50% of the cement and 70% of the other cargoes will pass through the transit shed, the required area of this facility can be estimated using the following formula:

$$A = \frac{N}{R\alpha w}$$

where,
- A : Area required for the shed (m^2)
- N : Annual cargo volume through the shed (115.6 thousand tons)
- R : Rotation rate of cargo per year (24 times/year)
- α : Coefficient of shed utilization (0.5)
- w : Average storage capacity (2 tons/m^2)

Accordingly,

$$A = \frac{115,600}{24 \times 0.5 \times 2.0} = 4,816 \fallingdotseq 5,000 \text{ m}^2$$

(3) **Warehouse Area**

An area sufficient to build the warehouses is to be secured in the second zone behind the quaywall.

7.2.3 Domestic General Cargo Wharf

According to the data obtained from the statistics of PMU Batangas, ships calling at Batangas Port are basically classified into two groups: those less than 500 DWT which mainly ply between Batangas and Mindoro Island, and those from 500 to 6,000 DWT which travel the inter-island shipping lanes. Therefore, the cargo volume has also been divided into two groups as shown in Table 7.2.2.

Table 7.2.2 Domestic Cargo Volume by Group (2000)

(1000 tons)

Commodity	Cargoes Carried by Ships less than 500 DWT	Cargoes Carried by Inter-island Ships	Total
Palay/Rice	8	–	8
Copra	2	–	2
Fertilizer	14	27	41
Minerals	–	9	9
Logs	6	28	34
Wood Products	20	28	48
Cement	10	–	10
Other Cargoes	20	14	34
Total	80	106	186

The following premises are made for planning the domestic general cargo wharf:

1) The average cargo handling rate is assumed as 1,000 tons/m for the inter-island ships, and as 900 tons/m for small ships less than 500 DWT.

2) Ship sizes used for determining the berth length and water depth of the quaywall are 5,000 DWT for the inter-island ship wharf and 500 DWT for the small ship wharf.
Based on the data, the number of berths necessary to accommodate the cargo volume, the dimensions of the wharf in terms of water depth and berth length, and the required size of the transit shed are estimated as follows:

(1) **Number of Berths**

The equivalent berth length required to cope with the cargo volume is calculated at 106 m for the inter-island shipping and 87 m for the small ship berth. As the required berth length for a 5,000 DWT ship is 130 m, one berth is necessary for inter-island shipping. As for the small ship berth, considering that the required berth length for a 500 DWT ship is 65 m, two berths are necessary.

(2) **Depth of the Quaywall**

The maximum draft of a 5,000 DWT ship ranges roughly from 6.1 m to 6.9 m judging from the relation between weight dead tonnage (DWT) and full draft as shown in Appendix 7.1. Therefore, the depth of the quaywall is –7.5 m. As for the two small ship berths, a depth of –4.5 m has been secured which can accommodate vessels up to 700 DWT.

(3) **Transit Shed**

On the assumption that 60% of the total domestic cargo volume except logs passes through the transit shed, the required area of the transit shed can be calculated by using the same formula as used when considering foreign general cargo. Annual cargo volume through the shed is 91,200 tons per annum in the year 2000.

Accordingly,

$$A = \frac{91,200}{24 \times 0.5 \times 1.8} = 4,222 \fallingdotseq 4,200 \text{ m}^2$$

7.2.4 **Steel Products Wharf**

In order for Batangas Port to make a great contribution to improving the steel distribution situation around the Metro Manila areas as well as to improving the quality control of steel products, a steel products wharf including suitable cargo handling machines and storage facilities is planned as a center for distributing the steel products. In relation with this wharf, an area for related secondary fabricating firms is secured so as to organize a steel fabricating industry complex to minimize overall transportation costs and to provide convenience for the customers. The scale of the wharf and the secured area are as follows:

(1) **Maximum Cargo Volume in the Year 2000:**

1,200 thousand tons for domestic trade and 200,000 tons for imported steel products and other heavy cargoes.

(2) **Area Required for the Steel Products Wharf:**

The area of 160,000 m² is required for cargo handling yard, warehouse, open storage, maintenance shop and administration office.

(3) Wharf:

- Quaywall with a water depth of –12M:
  1 Berth ...... foreign trade
- Quaywall with a water depth of –7.5M:
  3 Berths ...... domestic trade

(4) Storage Facilities:

- Warehouse ...... 5 units : 23,000 m²
- Open storage : 35,000 m²

(5) Cargo Handling Machines:

- Rope trolley crane, 25 tons : 2 units ...... for foreign trade
- Level luffing crane, 10 tons : 3 units ...... for domestic trade
- Truck crane, 40 tons : 1 unit ...... for domestic trade

(6) Unloading Ability:

An unloading rate of 120,000 tons per month can be attained by using the cargo handling machines at the domestic trade wharves.

(7) Area for the Related Secondary Fabricating Firms: 220,000 m²

7.2.5 Fertilizer Wharf

In the Southern Tagalog provinces including Quezon as well as in Mindoro, the agricultural sector still makes a major contribution to the regional economy. In order to attain self-sufficiency of rice in the Philippines and to promote the agro-industries in the hinterland, a large volume of fertilizer is likely to be consumed in Regions IV and V. Of this fertilizer, imported urea will be handled at Batangas Port by the construction of a wharf deep enough to accommodate large vessels. In the future, fertilizer will very likely be imported in bulk by larger ships than at present.

Vessels of the 5,000 ~ 7,000 DWT class carry much of the fertilizer delivered to Manila Port in 1983. However, at Batangas Port, a new specialized fertilizer wharf will not only accommodate 15,000 DWT vessels, but will also help reduce congestion at Manila Port. Furthermore, introduction of mechanical unloading facilities at Batangas Port will bring about a much higher cargo handling rate than the present rate of 800 ~ 1,000 tons per day at Manila Port.

The premises in planning are as follows:

1) The 200 cargo volume is 160,000 tons of urea.
2) Unloading rate is 250 ~ 300 tons per hour.
3) The average cargo lot-size is 7,000 tons/ship.
4) Annual working days are 305 days.
5) The necessary time to enter/depart the port is two hours.

(1) Number of Berths

Based on the premises, the number of ships calling at the Port in the year 2000 and average mooring hours per ship are estimated to be 23 ships and about 46 hours per ship, respectively. Therefore, total mooring hours can be calculated as 1,058 hours.

From these figures, the berth occupancy ratio is calculated at about 25%. Accordingly, one berth is required for importing fertilizer in 2000.

(2) Warehouses

The storage volume required for warehouses is determined by using the same considerations as used in estimating the area of the transit sheds. The rotation rate of fertilizer is said to be 4 ~ 5 times per year. Therefore, the required capacity is roughly 35,000 tons. Also, as the ship-size that will call at Batangas Port is assumed to be 15,000 DWT, the storage capacity of warehouses should be at least 13,000 tons.

From these considerations, the capacity is calculated as 35,000 tons in 2000.

7.2.6 Roads

Roads are one of the most important backup facilities of the Port. In view of the expected growth in the port's cargo volume, it is indispensable for the activities both of the Port and of Batangas city that standardized roads [see Fig. 7.2.1 (1) ~ 7.2.1 (3)] be secured to meet the needs of future development.

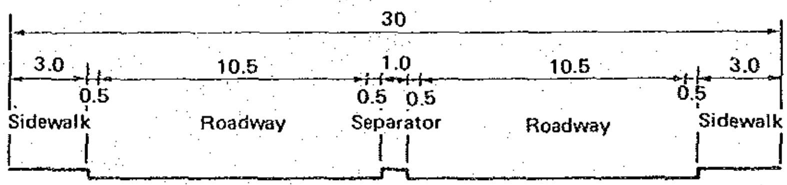


Fig. 7.2.1 (1) Standard Section of Trunk Road

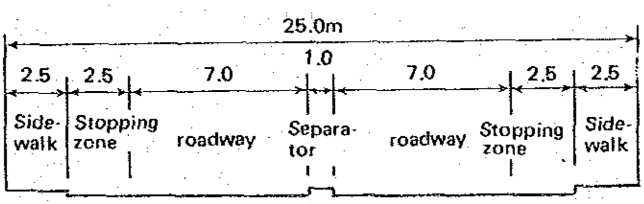


Fig. 7.2.1 (2) Standard Section of Principal Road

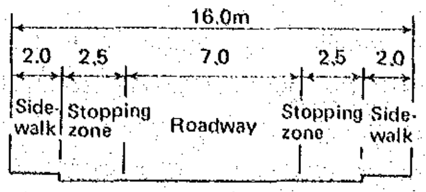


Fig. 7.2.1 (3) Standard Section of Branch Road

At present, one access road is connecting the port to the hinterland passing through Batangas city.

Judging from the current traffic congestion in the mid-town area, it is advisable to construct another access road, as a bypass, as soon as possible.

The necessary number of roads lanes is determined by the following formula:

$$T = z \times \frac{\alpha}{w} \times \frac{\beta}{12} \times \frac{\gamma}{\xi} \times \frac{1+\delta}{\epsilon} \times \sigma$$

where, T : Design traffic volume (vehicles/hour)

z : Annual cargo volume (tons)

w : Average real loadage of a truck (tonnage/truck)

α : Share of modal split by trucks

β : Monthly variation (peak month/ordinary month)

γ : Daily fluctuation (peak day/ordinary day)

δ : Ratio of related vehicles (related vehicles/all trucks)

ϵ : Real load ratio (loaded trucks/all trucks)

σ : Hourly fluctuation (traffic volume of peak hour/traffic volume of peak day)

ξ : Average number of days operated per month

Adopting the empirical values for the parameters,

$$T = 2{,}521{,}000 \times \frac{1.0}{3.0} \times \frac{1.2}{12} \times \frac{1.5}{25} \times \frac{1+0.5}{0.5} \times 0.16 = 2{,}420 \text{ vehicles/hr.}$$

Accordingly, the necessary number of lanes is determined on the basis of a per lane traffic capacity of 600 vehicles/hour.

In addition to the present access road with two lanes, another access road with four lanes will be required in 2000.

7.2.7 Other Facilities

Aside from the Ro-Ro and Ferry wharf, and cargo handling wharfs, a basin for small ships is necessary as a supplementary facility for port operation. Several port services call for some twelve to fifteen small ships including tug boats, pilot boats and other ships used for line handling and port security. Also, the area required for the offices in charge of these port operations should be secured as near the basin as possible in order to promote effective operations. Thus, a water area of about 3,000 m^2 is secured at the most southern part of the port area to accommodate these vessels. Further, a land area of about 10,000 m^2 is secured for the administrative facilities including the required service area for these vessels.

7.2.8 Overall Berth Allotment

The number of berths required for handling the cargo volume in the year 2000 is summarized as shown in Table 7.2.3.

Table 7.2.3 Berth Allotment in 2000

Trade Type	Cargo Volume ('000 tons) < A >	Vessel Size	Depth (m)	Handling Capacity (t/m) < B >	Required Berths: m <A/B>	Required Berths: Number of Berths
• Ro-Ro (for Calapan)	907	700 GT	-5.0	-	-	3 berths*
• Ro-Ro (for West Mindoro)	190	500 GT	-5.0	-	-	1 berth**
• Ferry	(passenger)					4 berths (existing)
• Foreign Trade						
(1) Cement	130	15,000DWT	-10	1,200	109	1 berth (185 m)
Mineral	19			1,000	19	
Other cargo	39			1,000	39	
(2) Steel	200	30,000DWT	-12	3,000	67	1 berth (240 m)
Heavy general cargo	30			1,000	30	
(3) (Fertilizer)	160	15,000DWT	-10	3,000	53	1 berth (185 m)
• Domestic Trade						
(1) Fertilizer	27	5,000DWT	-7.5	1,000	106	1 berth (130 m)
Minerals	9					
Logs	36					
Wood Products	20					
Other cargo	14					
(2) Palay/Rice	8	500DWT	-4.5	900	87	2 berths (120 m)
Copra	2					
Fertilizer	14					
Wood Products	24					
Cement	10					
Other Cargo	20					
(3) (Steel)	1,200	5,000DWT	-7.5	3,000	400	3 berths (390 m)
Total	3,063					13 (planned) 4 (existing)

Note: * Two new berths and one berth at Pier III which will be improved.
** Existing berth at Pier I which will be improved.

7.3 Master Plan

7.3.1 Alternative Sites

Based on the results of the port development site selection analysis conducted in Chapter 4, the development of Batangas Port will be carried out centered on the present port location.

Using the present location, we consider three alternative sites near the present port for development as shown in Figure 7.3.1.

Site A: Port development will be carried out along the shoreline. Almost all the remaining shoreline of District I as classified in Chapter 4 will be developed by the year 2000. Selection of this site is consistent with coastal zone use concepts which state that the shoreline is of great importance and should be utilized as much as possible. However, if this site is chosen, the areas behind the port will become landlocked, and will be difficult to develop after the year 2000.

Site B: Future port facilities will be developed along half the remaining shoreline extending north from the present port. The rest of the valuable shoreline will be reserved for future port development after the year 2000. Thus, the area behind the coastline is developed as part of this site. This area is still mostly vacant apart from some residences, and development here would not significantly interfere with present usage. This area behind the coast should be secured for port development as soon as possible. Otherwise, the site will begin to be used for other purposes, for other purposes. and it may become difficult to use this area for port development because of potential conflicts of interest. Because the water depth increases drastically about 120 meters from the shore, port expansion through reclamation in this area is not advisable. Again, as urbanization is likely to proceed more rapidly than port development, the site should be secured quickly.

Site C: Port facilities will be developed at the offshore area between pier III and the mouth of the river Majuia. As this area is quite shallow, generally less than two meters under MLLWL, the site could be developed through reclamation work. However, the mouths of the Majuia and Calumpang rivers located south of this site make further development along the coast impossible. Furthermore, the areas behind the coast is already an established residential zone, and further development in this area is not possible.

Overall, Site B is clearly the best alternative. Site C does not include sufficient room for future development. Also, port development at Site C would use the last portion of the shoreline available to the inhabitants of the Batangas area for recreational purposes. Furthermore, development at Site C would be inconsistent with current city land use planning. Similarly, Site A would not leave sufficient space for future development. Using up all the shoreline before the year 2000 would make future port expansion difficult. Considering both present and future needs, Site B is best suited for the current development of Batangas Port.

Fig. 7.3.1 Selection of Construction Site

7.3.2 Alternative Layout Plans

Based solely on the criterion of location, Site B is superior. Nonetheless, before making a final decision on site selection, we consider layout plans for each of the sites. Such plans may further clarify the advantages and disadvantages of the proposed sites.

In formulating layout plans, the overall port area is usually classified into several zones in terms of the type of port activity: wharf zone, passenger zone, production zone, recreation zone, buffer zones, port administration and port service-related office zone, reserved zone, and inter-zone connection areas.

The wharf zone is the space for cargo handling activities within the port area. This zone includes aprons, cargo handling areas and warehouse areas.

The passenger zone encompasses all the facilities which passengers and cars, jeepnies, busses and trucks will utilize, including facilities for embarking and disembarking vessels such as car ferries and Roll on - Roll off vessels. The passenger zone facilities thus include the ferry wharf, the passenger terminal building, parking lots, and a park.

The production zone is composed of the land area for the port-related industries which will locate there, and of wharves for the exclusive use of these industries.

The recreation zone includes not only the water areas for the beach, the sailing zone and yacht harbor, but also a land area for a park which will be used by the workers at the port as well as the general public.

The buffer zones are composed of green belts, open space and waterways which will separate various zones which might adversely affect each other.

The port administration zone is the space for port administration offices and for other port related offices that will provide services for port operation.

The reserved zone is the space set aside for future port development. This is of the utmost importance to ensure continued smooth expansion of the port in the future.

Inter-zone connection areas are generally the spaces alloted for the construction of roads and railways connecting the various zones with each other and with the city located behind the port.

The locations of all these zones must be determined so that all the facilities belonging to the same category are put together, and can thereby function efficiently.

The passenger zone has been located away from the cargo handling facilities, taking into consideration the existing access road connecting the Port to the hinterland via Batangas City as well as the results of the consultation of PPA with the City Government of Batangas regarding the relocation of the affected squatters (refer to Appendix 7.4).

The cargo wharf zone in Alternative Plans A and B has been layed out at the northern part of the present base port of Batangas. The natural conditions examined in the field survey and laboratory tests have been considered in determining the faceline of the wharf. In Alternative Plan C, on the other hand, the cargo wharf zone has been located south of the planned passenger zone and Ro-Ro wharves.

The layout plans are shown graphically in Figure 7.3.2.

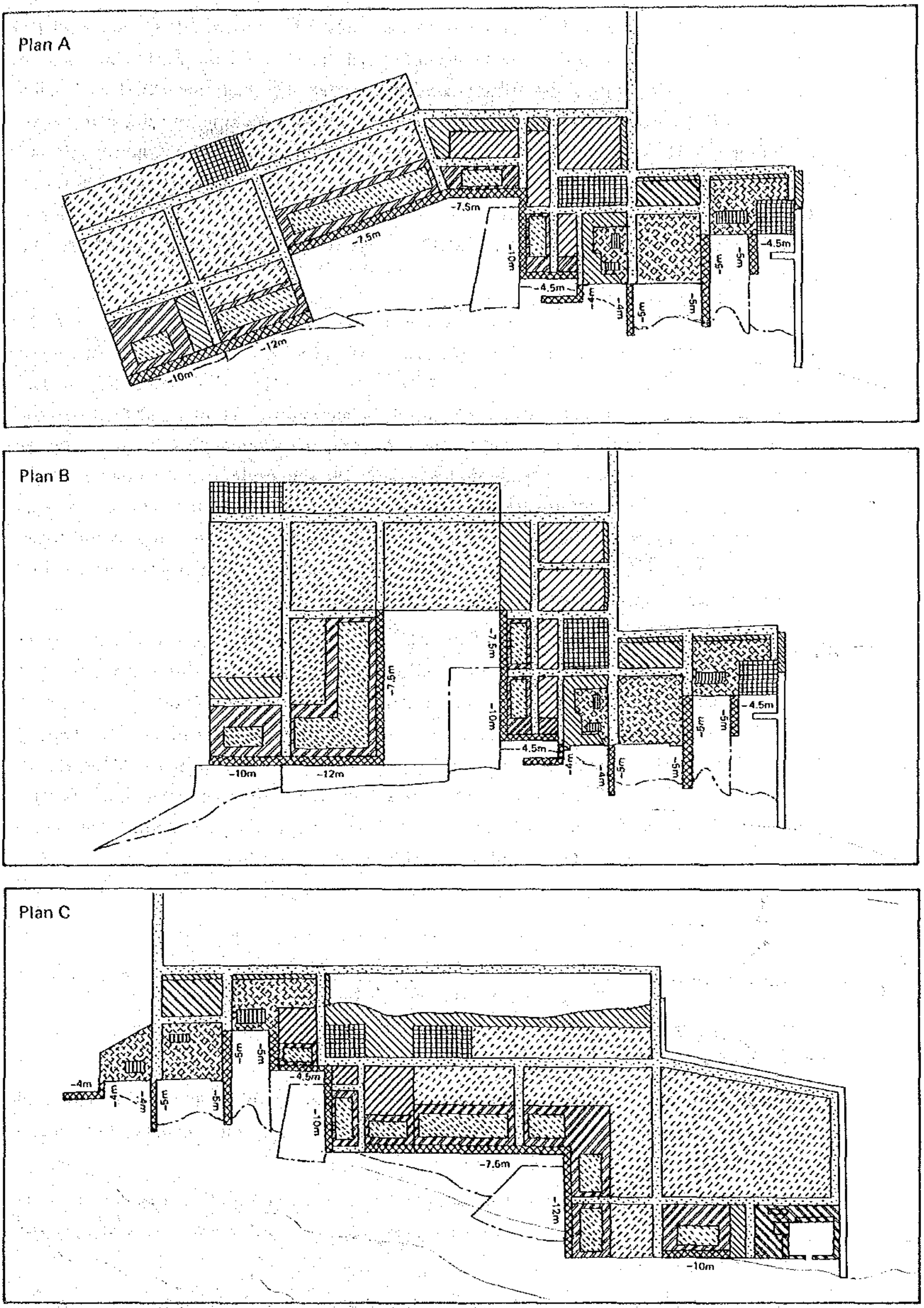


Fig. 7.3.2. Alternative Master Plans

Plan A: The outstanding feature of this plan is the location of cargo wharves required after 1990 all along the shoreline, creating a landlocked area behind the port which would be difficult to develop in the future. Under this plan, the marginal wharf extending from Pier II would be utilized as long as possible without making any improvements. If this pier were to be utilized as part of a new wharf, there would be numerous design and economic difficulties. However, Pier III which will serve as part of the ferry & Ro-Ro wharf would be improved under this plan because the length of the pier is currently not sufficient to accommodate vessels which are expected to utilize the port.

Plan B: Under this plan, the major wharves are constructed so that the vessels will moor in the same direction as the prevailing southwestern monsoon, that is, the stern of the vessels will face into the wind. The most important aspect of this plan is that in the future it will be possible to utilize the ample space behind the planned facilities for further port development by creating an artificially excavated port in this area, as shown by way of example in Appendix 7.5. Thus the remainder of the valuable waterfront area is preserved for future generations. Fundamental questions concerning the use of existing piers are the same as under Plan A. Road traffic generated to and from the cargo wharves in Plan B could easily be accommodate by constructing a new bypass which would circumvent the congested traffic in Batangas City.

Plan C: The shallow water area extending from Batangas Port to the mouth of the Majuia River is suitable for reclamation. Port facilities could be located within this reclamated area, and would be sufficient to handle traffic through the year 2000. Locating new port facilities in this area would interfere with the current mooring area for fishing boats. Thus, Plan C includes a new berthing area for the fishing boats. Measures to protect the area from siltation mainly caused by the Calumpang river include the reclaimed land itself which will act as a barrier, and a jetty extending from the southern edge of the reclaimed land to the 10 m water depth line.

7.3.3 Evaluation of Alternative Plans

(1) Criteria for Ealuation

The alternative plans are evaluated based on the following criteria:

1) Convenience

- Maneuverability – Vessels calling at the port should be able to maneuver easily and safely when entering and leaving the port and when berthing and deberthing at the quaywall.
- Layout – The facilities should be designed so that cargo can flow through the port efficiently. The location of cargo handling facilities and access roads affects the movement of cargo.
- Utilization of Facilities – Port facilities, such as transit sheds, open storage yards, wharves, and access roads; and cargo handling equipment, such as forklifts, trucks,

and mobile cranes, must be utilized efficiently.

2) Safety

o Calmness – The water should be as calm as possible.

o Emergency Measures – Facilities must be arranged so that personnel can effectively respond to any accidents which may occur in the port.

3) Construction Cost

o Total Construction Cost – The total cost should be minimized. One way to reduce costs is to design the facilities in such a way that the volume of earth to be dredged and the volume of earth necessary for land reclamation are equal.

4) Flexibility

o Adaptability – The plan should be adaptable to unanticipated changes in the future circumstances of the port and the region.

o Room for Future Development – It is important to reserve space for future port development adjacent to the planned facilities.

5) Environmental Protection

o Impact on the Social Environment – Deleterious effects of port development on the lives of the local inhabitants should be minimized.

o Impact on the Natural Environment – Water pollution and beach erosion due to port development should also be minimized.

(2) Selection of the Best Plan

Based on the above criteria, the three alternative plans are evaluated as summarized in Table 7.3.1. As a result of this comprehensive evaluation, as well as of the site evaluation, Plan B is recommended as the Master Plan, as shown in Figure 7.3.3.

Table 7.3.1 Evaluation of Alternative Plans

Criteria		Evaluation		
		Plan A	Plan B	Plan C
Convenience	Maneuverability	○	◎	◎
	Layout	◎	◎	○
	Utilization of Facilities	○	○	Δ
Safety	Calmness	○	◎	○
	Emergency Measures	◎	○	○
Economy	Total Construction Cost	○	○	Δ
Flexibility	Adaptability	○	○	○
	Room for Future Development	Δ	◎	Δ
Environment	Impact on Social Environment	○	○	Δ
	Impact on Natural Environment	○	○	Δ

Note: ◎ Excellent ○ Good Δ Some Problem

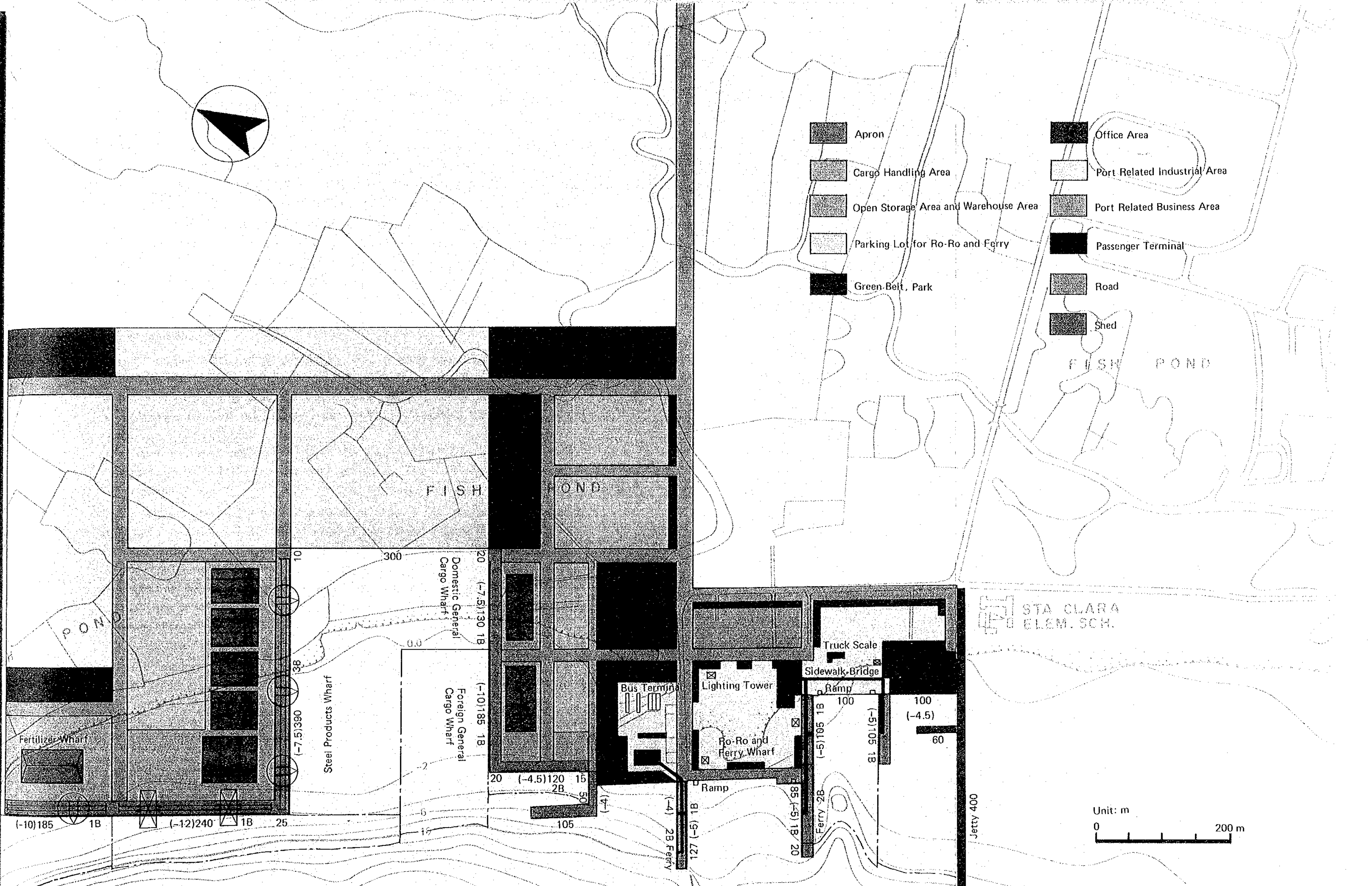


Fig. 7.3.3 Master Plan of Batangas Port (2000)

7.3.4 Alternative Layouts for the Ferry and Ro-Ro Wharf

The Ferry and Ro-Ro wharf is a very important facility for the port of Batangas. This wharf will be central to many of the activities at the Port. We have proposed three alternatives for the layout of this wharf. The location of the wharf is the same for all three of the alternative plans considered above. The three cases are shown graphically in Figure 7.3.4.

Case 1: Case 1 differs from the other two cases because under this case short term construction of the wharf can be carried out without any direct improvement to existing facilities. Accordingly, the present cargo handling capacity can be maintained using present facilities even during the implementation of the short-term plan. Another excellent point of this case is the spacious water area in front of the new Ro-Ro berths. Further, this case provides for future expansion through extension of the newly constructed pier at minimal cost.

Case 2: In this case, the faceline of the reclamation extends south from the existing causeway connecting Pier I and Pier III. Under the Short-term Plan one of the two Ro-Ro berths would be constructed by using the southern side of Pier III as part of the new wharf. The passenger terminal and parking area would be provided on the newly reclaimed land.

The water area sheltered by the jetty is narrower than in Case I. Thus, the newly constructed pier has little room for extension to accommodate increased demand after the year 2000.

Case 3: The new Ro-Ro berths are located along the faceline of the wharf just like the teeth of a saw. This plan calls for the removal of Pier III in order to construct the two required berths during the Short-term Plan.

Another difficulty is that this case would result in a concentration of cars and passengers at the wharf, particularly when ships are scheduled to arrive or depart at or about the same time. In terms of construction cost, Case 3 is the most expensive of the three alternatives.

Based on these considerations, Case 1 is the most preferable alternative among the three.

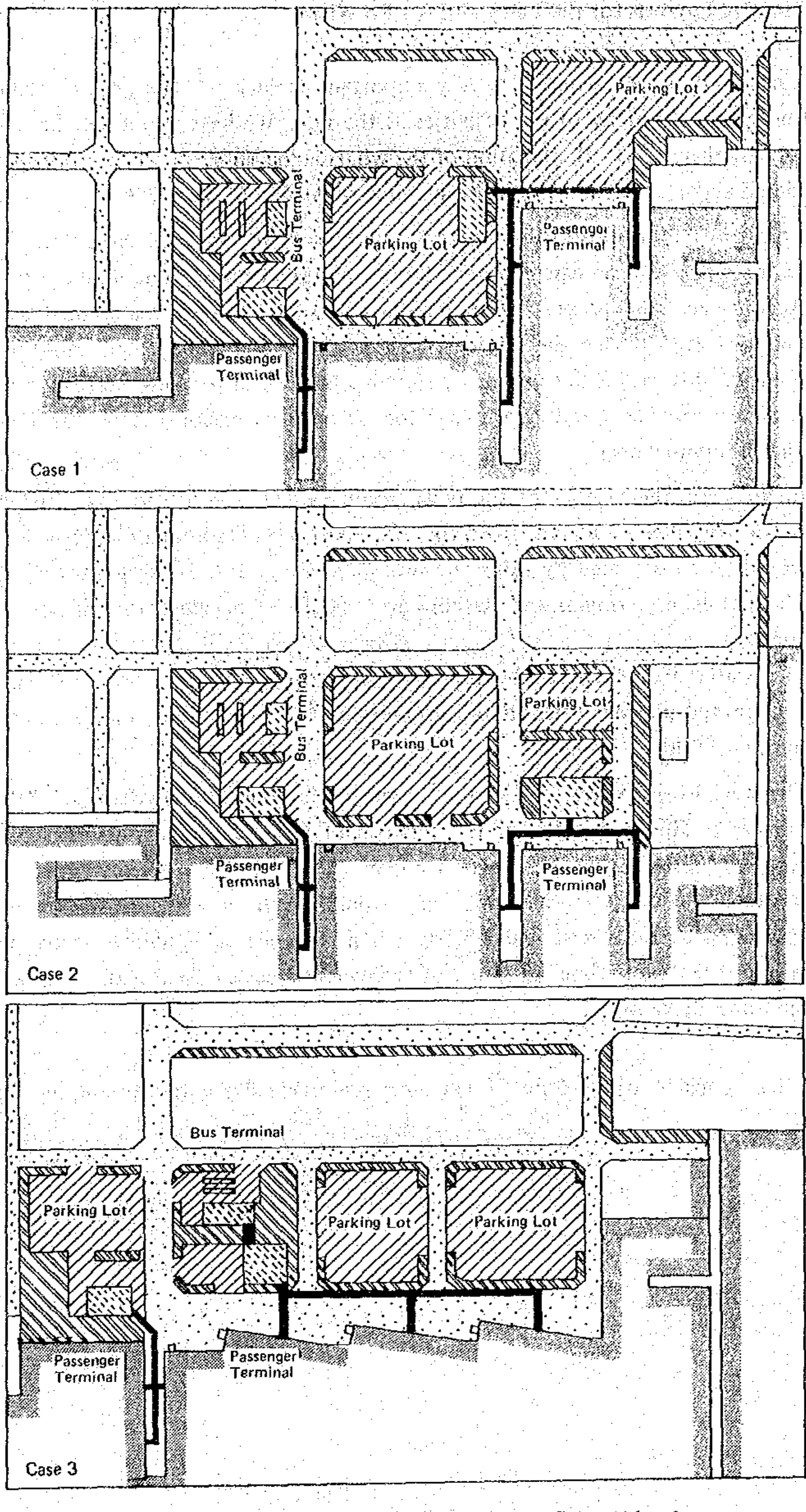


Fig. 7.3.4 Alternatives for Ro-Ro and Ferry Wharf

7.4 The Short-term Development Plan

Within the framework of the Master Plan, the Short-term Development Plan for the year 1990 is arranged in order to meet the cargo demand at that time.

7.4.1 Ro-Ro Wharf

According to the cargo volume projection for the Ro-Ro type ships connecting Batangas and Calapan, inward and outward cargo volumes are 369 thousand tons and 227 thousand tons in 1990, respectively. Ro-Ro ships provide shuttle services between these two ports on the basis of daily shipping schedules. So, it is sufficient to examine how many daily trips will be necessary to cope with the inward cargo volume of 369 thousand tons. On the assumption that the average cargo lot size of a 500 GT Ro-Ro type ship is 180 tons (refer to Appendix 7.2), six shuttle services become necessary. Considering the present operations of the two shipping companies, three berths will be required for them to operate Ro-Ro services. So, the two new berths planned under the Master Plan will be constructed by 1990, and the existing berth (11-A) now being used for Ro-Ro ships will continue to be utilized as a supplementary berth for Ro-Ro operations.

The passenger terminal and parking-lot laid out just behind the two new Ro-Ro wharfs will also be constructed not only to provide the required facilities for Ro-Ro operation, but also to create a favourable amenity in the port area.

7.4.2 Foreign General Cargo Wharf

The total general cargo volume under the Short-term Plan amounts to 158 thousand tons. Based on the assumed cargo handling rates of 1,200 ton/m for cement and 1,000 tons/m for other general cargoes, the total required berth length is estimated as 141 m. Accordingly, the foreign cargo wharf planned under the Master Plan must be constructed as part of the Short-term Plan. The transit shed should also be completed as part of the wharf to ensure efficient cargo handling operation.

7.4.3 Domestic General Cargo Wharf

According to the basic concepts for port planning, the existing piers are to be utilized as much as possible. It is assumed that logs will probably continue to be handled at the marginal wharf as in the past. The remaining general cargo volume of 81 thousand tons will be handled at the two new wharves with a depth of −4.5 m and a length of 120 m adjacent to the −10 m foreign general cargo wharf.

7.4.4 Berth Allotment in 1990

The number of berths required under the Short-term Development Plan is summarized as shown in Table 7.4.1. In addition to the required berths, a basin for small ships is to be constructed to promote effective port operation. Thus, the Short-term Development Plan is formulated as illustrated in Figure 7.4.1.

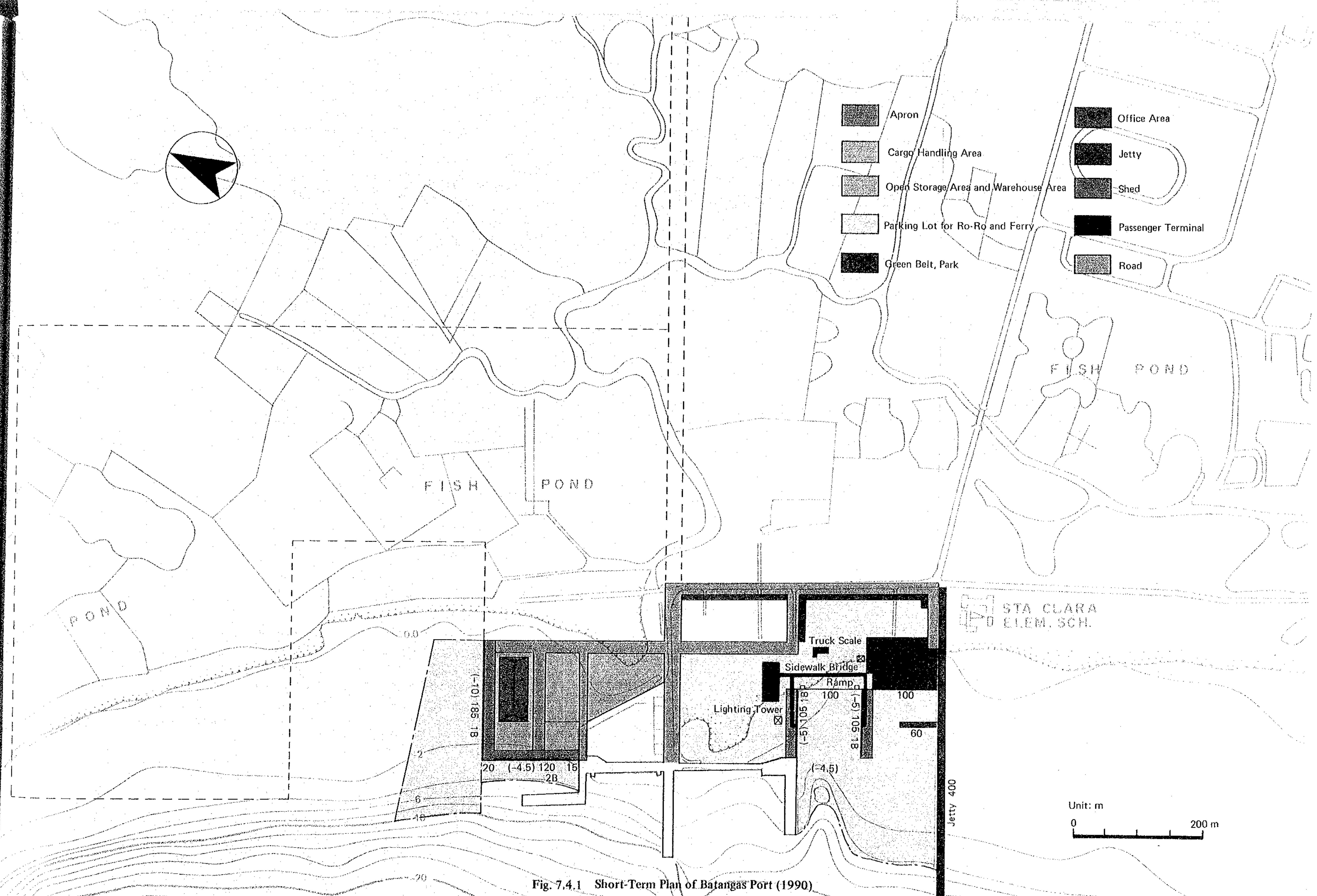


Fig. 7.4.1 Short-Term Plan of Batangas Port (1990)

Table 7.4.1 Berth Allotment in 1990

Trade	Cargo Volume (000 tons)	Depth (m)	Required Berths
o Ro-Ro (for Calapan)	596	-4.5	2 (enw) 1 (existing)
o Foriegn Trade	158	-10	1 (new)
Cement	(105)		
Minerals	(13)		
Other Cargoes	(40)		
o Domestic Trade	117		
(1) Rice	(10)	-4.5	2 (new)
Copra	(2)		
Cement	(19)		
Wood Products	(17)		
Other Cargo	(19)		
(2) Logs	(36)	-7.5	1 (existing pier II)
Wood Products	(7)		
Minerals	(7)		
Total	871		5 (new) 2 (existing)

7.4.5 Cargo Handling Facilities

For loading and unloading operations to be carried out as speedily as possible, it is necessary to obtain cargo handling facilities to carry cargo between the aprons and the stocking area. Acquisition of forklifts at the new cargo wharves is especially important for the maximal functioning of the large cargo handling yard and of the transit shed behind the yard. Under the Short-term Plan, forklifts will most likely take the leading role in carrying and handling cargo at the aprons in order for the new wharves to function as efficiently as possible.

The number of forklifts necessary to meet the requirements at the foreign trade wharf can be estimated by the following formula:

$$N = \frac{p \cdot n \cdot Q/q}{D \cdot H \cdot W}$$

in which N : Required number of forklifts

Q : Annual cargo volume (in tons)

q : Cargo handling rate (tons/gang/hour)

n : Number of forklifts per hatch

p : Peak day factor, $p = 1.0 \sim 1.5$ ($p = 1.2$)
D : Available working days of forklifts per annum, D = 335 days
H : Available working time of forklifts per day (hours) H = 16 hours
W : Coefficient of cargo handling of forklifts (W = 0.7)

the n-value is determined by taking cargo handling productivity and cargo packing types into account.

The required number of forklifts is estimated as approximately 5 units, as shown in Table 7.4.2.

Table 7.4.2 Required Number of Forklifts in 1990

Commodity	Cargo Volume	q	n	N	Remarks
Cement	24,000	20	2	0.76	Bagged goods
	30,000	20	2	0.96	
	36,000	20	2	1.15	
	15,000	20	1.5	0.36	
Minerals & Others	53,000	20	1.5	1.27	Bagged and other types
Total	158,000			4.50	

7.4.6 Simulation Tests

Simulation tests are carried out in order to ascertain whether or not the planned berth allotment is sufficient to handle the projected cargo volume. Simulation tests are useful as they employ queuing theory, and are therefore able to evaluate the efficiency of port operations in terms of port congestion as measured by ship waiting time. Such tests take irregularities in ship arrival time and working conditions into account, and thus the results of the simulation tests are more sophisticated than results based only on the projected cargo volume and the empirical cargo handling rate.

Here, simulation tests which determine the average waiting time for vessels in 1990, after the completion of the short-term facilities, are used to confirm the appropriateness of the planned number of berths (the with case). A simulation test is also conducted based on the projected cargo volume in 1990 under the existing facilities (the without case). This show how long the waiting time and service time will become if no expansion or improvements are made at the Port. The results of the both simulation tests are useful for planning and for economic and financial analysis.

The results of the simulation tests are summarized in Table 7.4.3. According to the results, the average waiting time for all ships calling at Batangas port will be reduced to 4.0 hours upon completion of the short-term facilities in 1990. If no improvements are made at the Port, the average waiting time will reach 2.8 days in 1990. Thus, the overall average waiting time will clearly be greatly reduced by the Short-term Plan.

However, as for the foreign trade wharf (–10 meters), the average waiting time will exceed the acceptable limit of 24 hours, mainly due to the irregularity in the arrivals of the vessels which will use this wharf. Another cause of excessive waiting time at the foreign trade wharf is the policy whereby inter-island vessels will also be allowed to berth there when the wharf is vacant. This will allow these inter-island vessels to benefit from the increased cargo handling efficiency at this wharf which is equipped with a wide apron and large cargo handling yard.

Permitting inter-island vessels to dock at the foreign trade wharf will also improve the cargo handling efficiency for the smaller domestic trade vessels, as these vessels will then be able to utilize more space at the marginal wharf where the inter-island vessels usually dock.

After 1990, the average waiting time for all ships calling at the Port will gradually increase. The average waiting time for those vessels using the wharves with depths of –7.5 meters and –10 meters will increase to almost 2 days by 1996. This excessive waiting time suggests the necessity of proceeding to the next stage of the development project.

Thus, an additional simulation test has been conducted, the "expansion case". Under this case, the waiting time is examined after the construction of the new domestic wharf (–7.5 meters) planned under the Master Plan. For this case, it is assumed that large inter-island vessels will no longer be allowed to berth at the foreign trade berth. However, on the other hand, oceangoing vessels of the 5,000 DWT class will be allowed to berth at the new domestic trade wharf. This new wharf is located next to the foreign trade wharf under the Short-term Plan. When foreign vessels berth at the new domestic wharf, they will be able to take advantage or the continuous berth operation made possible by this location, that is, that foreign vessels docking at the new wharf will be able to utilize the cargo handling equipment and transit shed located at the foreign wharf.

From the results presented in the Table, it is clear that the construction of the new wharf will greatly contribute to a reduction in the average waiting time for the larger inter-island vessels, and also to a reduction in the average waiting time for oceangoing vessels to within the acceptable limit of 24 hours.

Under the simulations, we note that the average waiting time for oceangoing vessels is somewhat longer than for the other ships calling at the Port. As mentioned above, this is partially because of the irregularity in the arrival time of these vessels. However, this may also be due to the somewhat conservative estimate of the cargo handling rate for oceangoing vessels: only 20 tons per gang per hour.

Considering the facilities of the wharf including a wide apron and a large handling yard, it is probable that the actual cargo handling rate will be somewhat higher, especially for uniformly bagged goods such as cement. We estimate that a rate of about 25 tons per gang per hour should be attained by the introduction of suitable cargo handling equipment.

Table 7.4.3 Average Waiting Time and Berth Occupancy Ratio

	1987 Without case	1998 Without case	1990 Without case	1990 (with case)	1993 (With case)	1996 (With case)	1996 Expansion case	Remarks
Overall average waiting time per ship (hrs/ship)	21.5	32.2	68.3	4.0	4.6	6.6	1.3	
Overall berth Occupancy (%)	62.2	71.5	85.8	39.3	43.7	49.5	36.6	
<Breakdown at wharf> Wharf : A	- -	- -	- -	37.5 38.8	38.7 40.1	51.7 41.8	26.0 52.5	-10 m new wharf (1 berth)
Wharf : B	- -	- -	- -	1.2 35.3	1.9 40.7	3.2 49.7	0.2 43.9	-4.5m new wharf (2 berths)
Wharf : C	24.4 74.6	36.6 86.7	94.9 99.1	32.5 43.1	34.1 46.9	48.6 51.4	4.4 15.5	-7.5m marginal wharf (existing)
Wharf : D	55.6 48.7	61.8 53.9	169.6 68.3	- -	- -	- -	- -	-2.7m berths at Pier III (2 existing berths)
Wharf : E	18.8 63.4	29.1 73.7	55.6 90.0	- -	- -	- -	- -	-5.0m berth at Pier I (existing)
Wharf : F	- -	- -	- -	- -	- -	- -	2.7 31.7	-7.5m new wharf (1 berth)
Wharf : G	- -	- -	- -	12.9 44.2	10.2 50.1	13.6 55.3	0.4 31.3	-4.5m berth at Pier II (existing berth)

Note: Upper figure and lower figures indicate the average waiting time at wharf and the berth occupancy ratio of the wharf, respectively.

CHAPTER 8
DESIGN AND COST ESTIMATE

CHAPTER 8 DESIGN AND COST ESTIMATE

The aim of the chapter is to make a preliminary design of the principal facilities and a rough estimate of the construction costs for the Master and Short-term Plan as determined in Chap. 7.

8.1 Preliminary Design of Principal Facilities

8.1.1 Selection of Facilities for Preliminary Design

In this section a preliminary structural design is made of the principal facilities called for in the Short-term Plan. These are:

A. Mooring facilities

- i) Ro-Ro vessel berth (pier)
- ii) Ro-Ro vessel berth (marginal wharf)
- iii) –4.5 m general cargo berth
- iv) –10.0 m general cargo berth
- v) Small craft berth

B. Jetty and breakwater

- i) Jetty (east part)
- ii) Jetty (west part)
- iii) Breakwater

The location of the above facilities is shown in Fig. 8.1.1.

A description of the preliminary structural design of other facilities is omitted in this section.

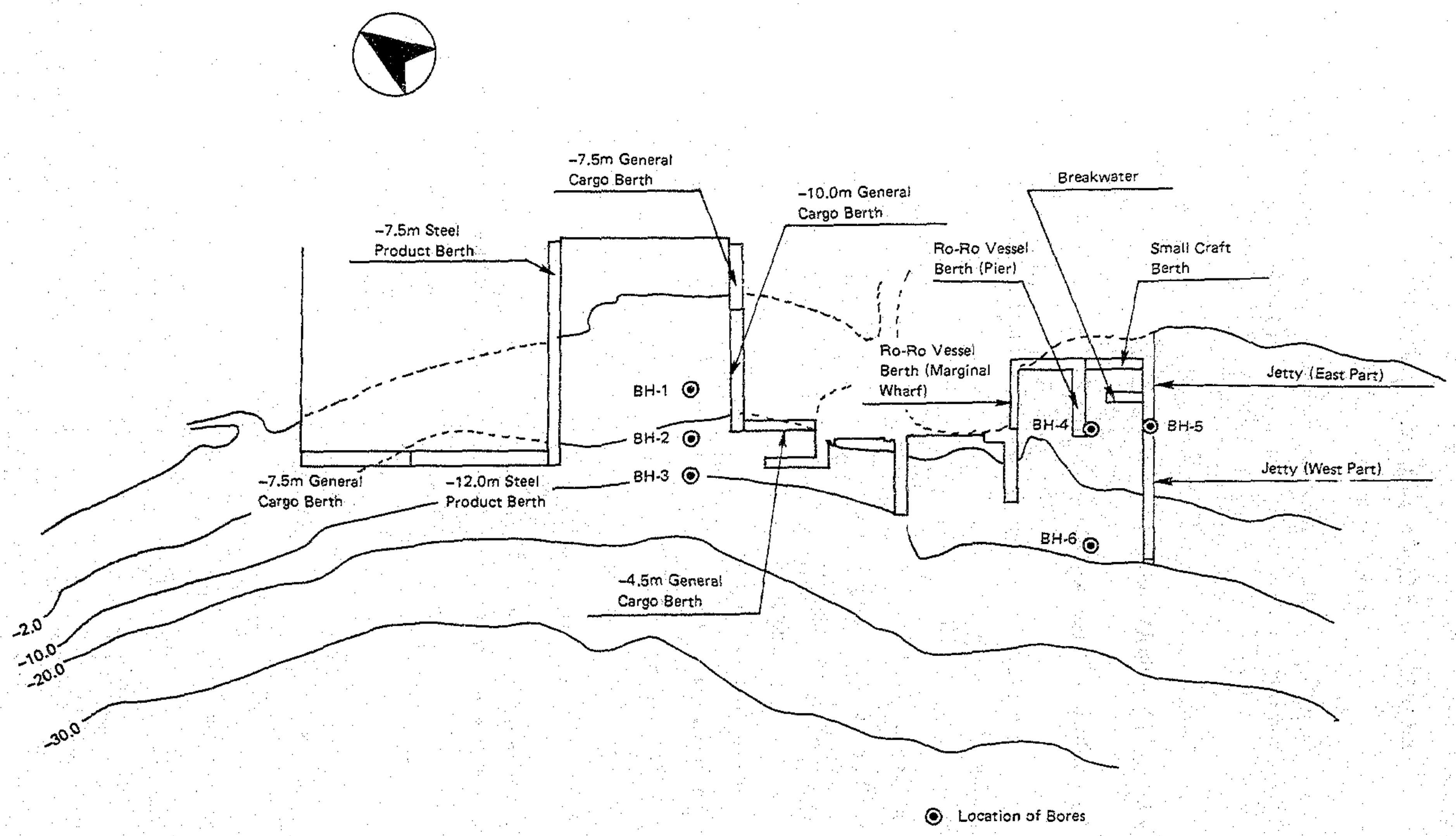


Fig. 8.1.1 Master Plan and Location of Bores

8.1.2 Preliminary Structural Design of Mooring Facliites

(1) Design Conditions

i) Tide levels

H.W.L. is +1.55 m and L.W.L. is +0.07 m. In this case, H.W.L. is defined as the year-long average water level of the monthly highest water levels, while L.W.L. is regarded as the average of the monthly lowest water levels.

These tide levels were derived from data obtained by the Study Team after one month's observation in the field at Batangas in 1984. Although the observation period is considered insufficient and the tide levels analyzed by the Study Team differ in some respects from the other data, e.g. the tide levels calculated from the Tide and Current Tables in the Philippines, the Study Team's results are applied here because there is no long-term record of the tide levels at Batangas which might confirm the accuracy of other tide level studies.

ii) Design water depth and crown height of structures

Design water depth and crown height of structures are determined as shown in Table 8.2.1.

The design water depth is equal to the control water depth which was determined in Chap. 7. However, the design water depth for the sheet pile structures has been made equal to the adjusted value plus a marginal depth of 0.5 m, necessary because of possible fluctuations in the dredged depth which might otherwise decrease the safety of the sheet pile type structures.

The crown height of mooring facilities was determined based on the "Technical Standards for Port and Harbour Facilities" in Japan (hereinafter referred to as "Technical Standards"), which present the following guideline:

$$(\text{Crown Height}) = \text{H.W.L.} + (1.0 \sim 2.0)\ \text{m}$$

Table 8.1.1 Design Water Depth and Crown Height of Structures

Facility	Max. Vessel Size	Design Water Depth (m)	Crown Height (m)
Ro-Ro Vessel Berth (Pier)	700 GRT	-5.0	+2.9
Ro-Ro Vessel Berth (Marginal Wharf)	700 GRT	-5.0	+2.9
-4.5 m General Cargo Berth	700 DWT	-4.5	+3.2
-10.0 m General Cargo Berth	15,000 DWT	-10.0	+3.2
Small Craft Berth	–	-4.5	+2.9

iii) Seismic coefficient

When designing the mooring facilities, seismic force is regarded as one of the horizontal forces. The seismic coefficient has been assumed as 0.15.

The horizontal force due to earthquakes was calculated on the basis of the "National Structural Code for Building" (in the Philippines). The formula to be applied is as follows:

$$V = Z \times I \times K \times C \times S \times W$$

where:

V : Horizontal force due to earthquakes
Z : Numerical coefficient dependent upon the seismic zone
I : Numerical coefficient related to importance of the structure
K . Numerical coefficient related to the type of structure
C : Numerical coefficient for base shear
S : Numerical coefficient for site-structure resonance
W : Weight of structure

The numerical coefficient (Z) is determined based on the classification of seismic zone. The project area is classified as Zone 3. According to the "Code", the value of Z is taken as 0.75. The coefficient of I ranges from 1.0 to 1.5. The figure (K x C) is in the range between 0.12 and 0.25. The "Code" recommends that the value of S should be 1.5 when the characteristic site period is not properly obtained. Thus the figure (I x K x C x S) was calculated as 0.18 to 0.56. However, the above "Code" is established mainly for designing architectural rather than civil engineering structures. In consideration of the characteristics of seismic oscillation and the importance of the structures, the seismic coefficient used in designing the mooring facilities should be no higher than 0.18.

Under these conditions, the horizontal force can be calculated as follows:

$$\begin{aligned} V &= 0.75 \times 0.18 \times W \\ &= 0.14\,W \rightarrow 0.15\,W \end{aligned}$$

(The design seismic coefficient shown above was rounded off to the nearest 0.05 or 0.00 in accordance with "Technical Standards.")

iv) Surcharge

Surcharge was determined empirically based on intended use of the facilities as outlined in the Master Plan. The surcharge is seismic cases was half the value assigned in ordinary cases.

Table 8.1.2 shows the surcharge used in the preliminary design.

Table 8.1.2 Surcharge of Mooring Facilities

Facility	Surcharge (t/m^2)	
	Ordinary Case	Seismic Case
Fo-Ro Vessel Berth	1.0	0.5
-4.5 m General Cargo Berth	1.0	0.5
-10.0 m General Cargo Berth	2.0	1.0
Small Craft Berth	0.5	0.25

v) Berthing velocity

Berthing velocity of vessels is empirically determined as follows:

a) Ro-Ro vessels (700 GRT) : 0.20 m/sec

b) General cargo ships (700 DWT) : 0.15 m/sec.

c) General cargo ships (15,000 DWT) : 0.10 m/sec

vi) Soil conditions

Based on the soil investigation results described in Chap. 3, the supposed soil conditions are shown in Fig. 8.1.2. (The location of the bores in the Master Plan is shown in Fig. 8.1.1.)

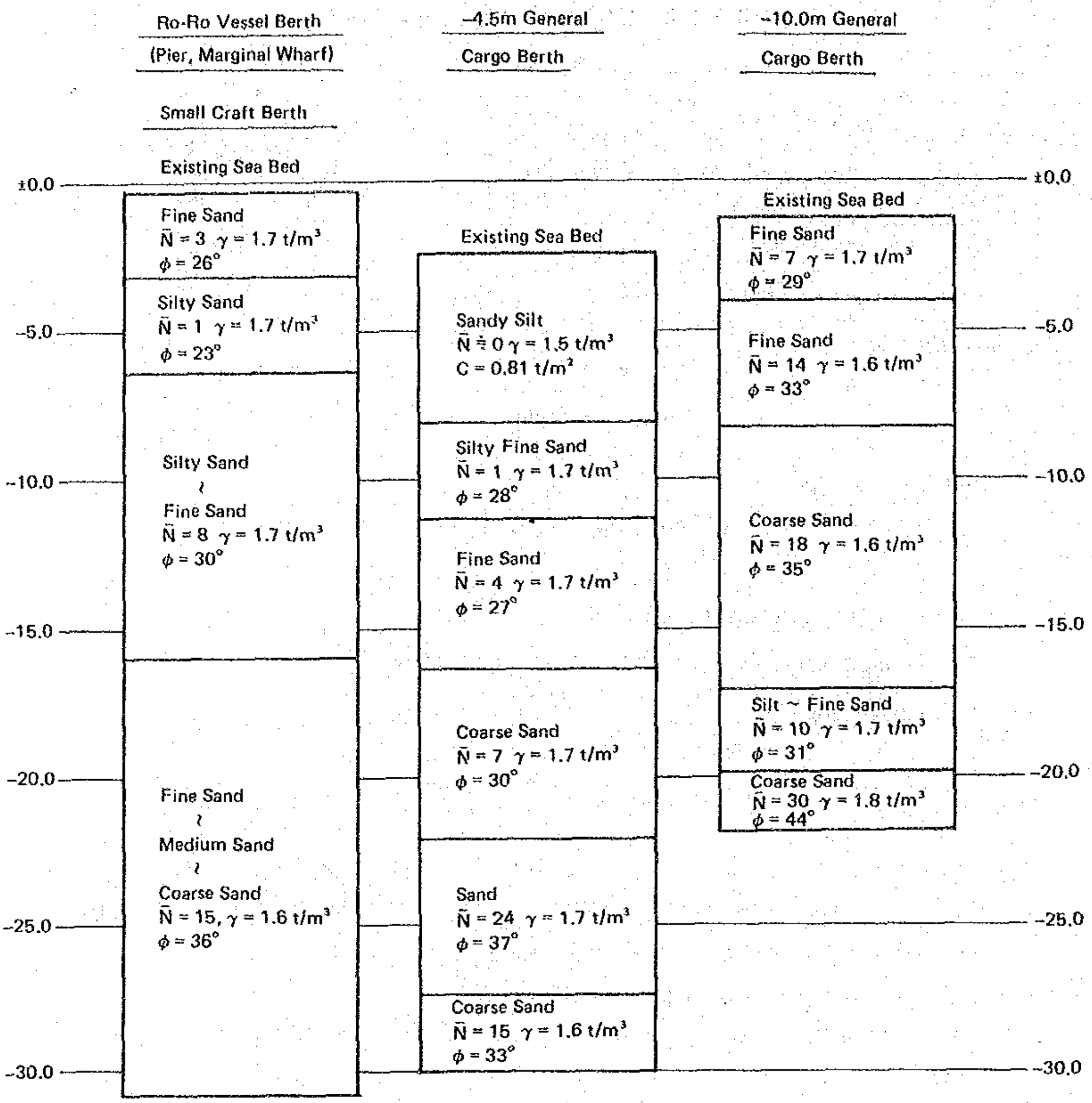
Since the Study Team's soil investigation does not cover the entire area of the Master Plan, the soil conditions in the design of the mooring facilities were assumed from the soil data of the boring point nearest the planned site.

vii) Allowable stress of steel and concrete

The allowable stress of steel and concrete is based on the "Technical Standards," as shown in Table 8.1.3.

viii) Corrosion rate of steel

The corrosion rate of steel is based on the "Technical Standards," as shown in Table 8.1.4. However, above sea bottom, polyethylene coatings will be put on the seaside surface of steel sheet piles and pipe piles. Thus, the seaside corrosion of steel is neglected in the preliminary structure design for the sheet pile type and open type.



Note: The simbols, N, γ, ϕ and C have the following meanings:

- $\bar{N}$: Average N-value by standard penetration test
- γ : Unit weight of soil
- ϕ : Internal angle of friction of soil
- C : Cohesion of soil

Fig. 8.1.2. Soil Conditions

Table 8.1.3 Allowable Stress of Steel and Concrete

Materials	Quality Standard*2	Type of Stress*1	Allowable Stress (kg/cm^2)	
			Ordinary Case	Seismic Case
Steel Sheet Pile	SY 30	B.T.S.	1,800	2,700
		B.C.S.	1,800	2,700
	SY 40	B.T.S.	2,400	3,600
		B.C.S.	2,400	3,600
Steel Pipe Type Sheet Pile	STK 41	B.T.S.	1,400	2,100
		B.C.S	1,400	2,100
Steel Pipe Pile	STK 41	B.T.S.	1,400	2,100
		B.C.S.	1,400	2,100
		A.T.S.	1,400	2,100
		A.C.S.	*3	*3
Tie-Rod	SS 41	A.T.S. ($\phi \leq 40$ mm)	960	1,440
		A.T.S. ($\phi \geq 40$ mm)	880	1,320
	HT 45	A.T.S.	1,800	2,700
Steel Bar	SR 24	A.T.S.	1,400	2,100
Concrete	–	B.C.S.	60	90

Note: *1 Based on JIS (Japanese Industry Standard).
*2 B.T.S. : Bending tensile stress
B.C.S. : Bending compressive stress
A.T.S. : Axial tensile stress
A.C.S. : Axial compressive stress
*3 The allowable axial compressive stress of steel pipe piles in ordinary cases is determined by the following formulae. The allowable stress in seismic cases is one and a half times in ordinary cases.

$$\frac{\ell}{r} \leqq 20 : 1{,}400\ (kg/cm^2)$$

$$20 < \frac{\ell}{r} < 93 : 1{,}400 - 8.4\left(\frac{\ell}{\gamma} - 20\right)\ (kg/cm^2)$$

$$\frac{\ell}{r} \geqq 93 : \frac{12{,}000{,}000}{6{,}700 + (\ell/\gamma)^2}\ (kg/cm^2)$$

where, ℓ : Effective buckling length of member (cm)
r : Radius of gyration of area for cross sectional area of member (cm)

Table 8.1.4 Corrosion Rate of Steel

	Corrosion Environment	Corrosion Rate (mm/year)
Sea Side	Above H.W.L.	(0.3)
	Between H.W.L. and the sea bottom	(0.1)
	Below the sea bottom	0.03
Land Side	In marine atmosphere	0.1
	In soil (above the residual water level)	0.03
	In soil (below the residual water level)	0.02

ix) Design lifetime of structure

The design lifetime of structures has been determined as fifty (50) years.

(2) Type of Structure for Preliminary Design

Since the Ro-Ro vessel berth (marginal wharf) and the −10.0 m general cargo berth are considered the most significant structures in the Short-term Plan, alternative designs were carried out for these two facilities.

As for the other mooring facilities, preliminary designs of the appropriate type were made.

i) Ro-Ro vessel berth (marginal wharf) and −10.0 m general cargo berth.

Three alternative designs of common types, i.e. gravity type, sheet pile type and open type were carried out to determine a basic structure type for the Ro-Ro vessel berth (marginal wharf) and the −10.0 m general cargo berth. In addition to these three types, the relieving platform typê (sheet pile tipe with relieving platform) and the cellular cofferdam type are conceivable. However, these two types were exluded as alternatives because they are inferior to the three common types in terms of construction cost and simplicity of execution.

In the sheet pile type design, combined oblique piles were applied as the anchoring system in consideration of the significance of the structures as well as for increased safety should liquefaction of the soil take place. This, however, entails higher construction costs than would conventional anchoring systems.

ii) Other mooring facilities

The Ro-Ro vessel berth (Pier) was designed as an open type, which is the most common judging from the configuration of the Short-term Plan.

The −4.5 m general cargo berth was designed as a sheet pile type for the following reasons;

a) Judging from the supposed soil conditions (Fig. 8.1.2), a soft layer exists to −11.0 m. Using a gravity type would therefore increase construction costs because the soft layer must be replaced by good sand.

b) Due to the soft layer, an open type here would require a deeper concrete deck