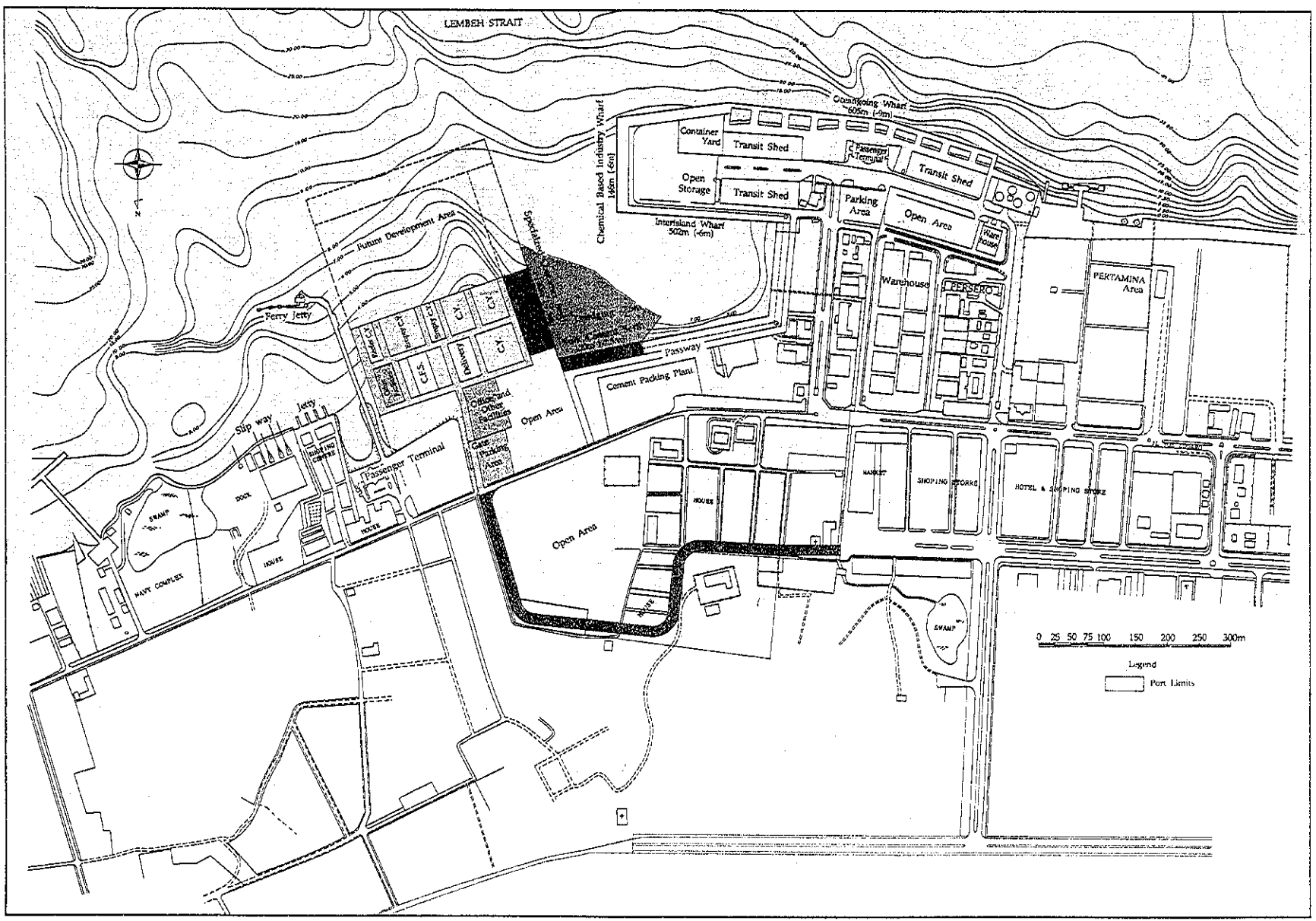


Figure 6-6 Bitung Port Development (Alternative 2)

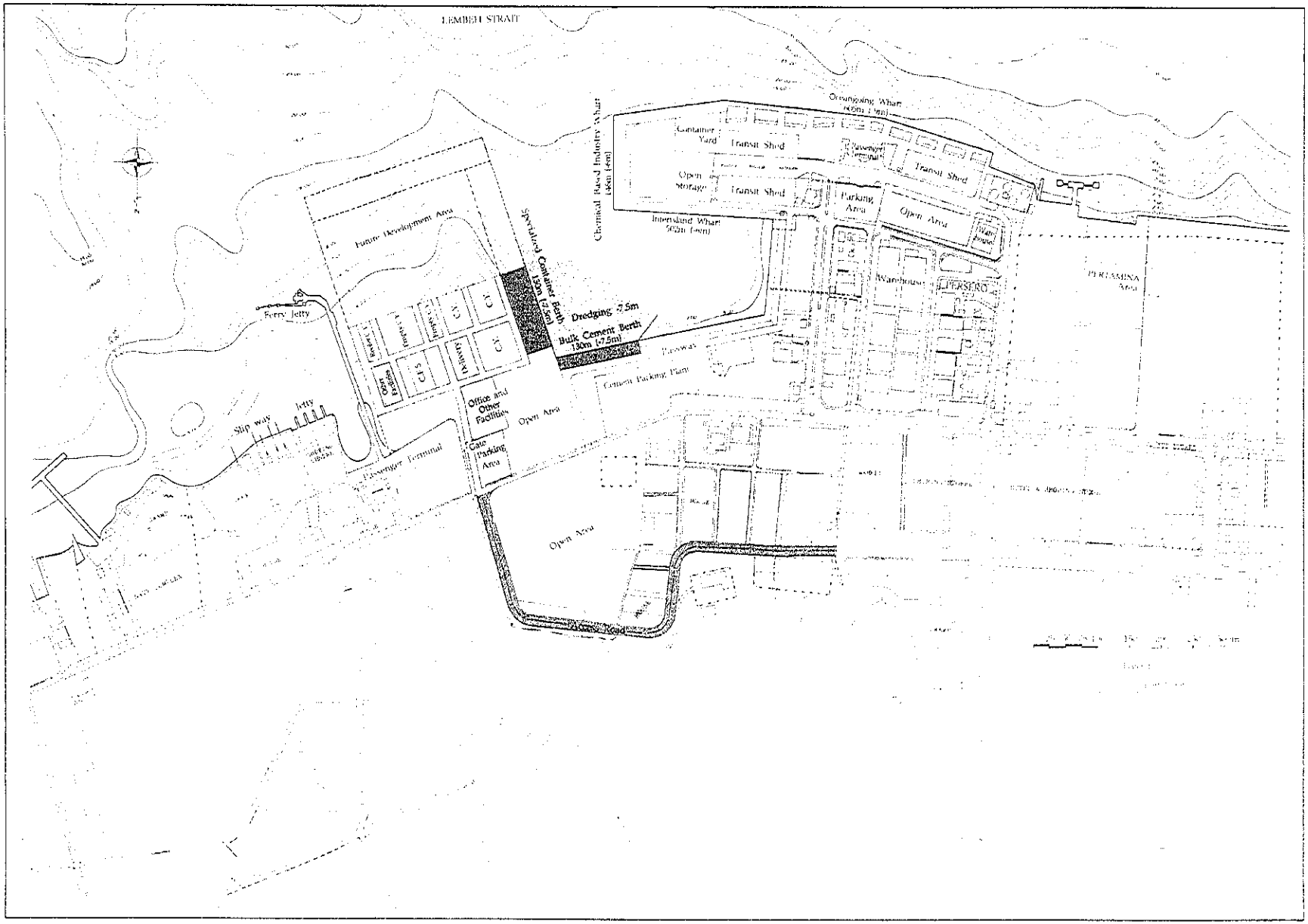


Figure 6-6 Bitung Port Development (Alternative 2)

G. Evaluation of the Alternative Layout Plans

General

115. Each alternative has its inherent advantages and disadvantages. Therefore, it is very important to evaluate the alternative layout plans to select the optimum plan.

Alternative 1

116. Alternative 1 has the following inherent advantages;

(1) The existing Local Wharf will be able to continue to be operated in 2000.
(2) Most of the container terminal area is the land reserved area which belongs to PERSERO, so it is not necessary to purchase land.

(3) The new reclamation area is limited, so the construction cost is low.

(4) When the demand of container cargoes increases, it is easy to expand the additional container terminal without hindering the port operation.

117. On the other hand, Alternative 1 has the following inherent disadvantages;

(1) If the storage capacity of this container terminal is exceeded, an additional storage area will have to be generated by a new reclamation.

(2) The lay of the container terminal is distorted, so there is some dead space in the container terminal.

Alternative 2

118. Alternative 2 has the following inherent advantages;

(1) The lay of the container terminal is quadrilateral, so there is little dead space in the container terminal.

(2) A part of revetments will be able to be used as the structure of future expansion.

(3) If the storage capacity of this container terminal is exceeded, an additional storage area can be secured without reclamation.

119. On the other hand, Alternative 2 has the following inherent disadvantages;

(1) The existing Local Wharf will not be able to operate in 2000.

(2) Most of the container terminal area is a new reclamation area, so the construction cost is expensive.

Conclusion

120. From the above observation, it is concluded that Alternative 1 is the more adequate layout plan for future development of this port.

H. Consideration of Degree of Calmness

Criterion of calmness

121. Generally, a mooring basin or anchorage for ships must be sufficiently calm to permit mooring or anchoring at least 95% of the year in front of the wharf.

122. A limiting condition that allows ships to anchor or take up berth is chiefly determined by elements of wave height, which are to be established in accordance with the manners of use; it is set at less than 0.3 m for small vessels of 1,000 G/T class, less than 0.5 m for medium sized vessels between 1,000 G/T and 5,000 G/T class and less than 0.7 m to 1.5 m for larger vessels.

Degree of sheltering (Degree of calmness)

123. Being sheltered by Lembeh Island on the opposite shore, Bitung Port is little affected by direct deepwater waves. Results of wind hindcasting made from the information on winds collected at the existing wharf during 1991 are shown in Table 6-2.

124. As the fetch from each direction is shown in Figure 6-7, influence of the open sea is limited from SW and WSW as Lembeh Island prevents intruding from other directions.

125. The currently proposed berth is to be used for medium sized vessels, and as the limiting wave height is 0.5 m, occurrence frequency above it is 0.1%, that is, 99.9% is a usable rate.

126. Furthermore, taking into consideration the diffraction from the existing wharf area into the mooring basin as indicated on Figure 6-8, wave height ratio is assumed to decrease by 80 percent (80%) at the proposed berth and a fair calmness in the mooring basin can be secured.

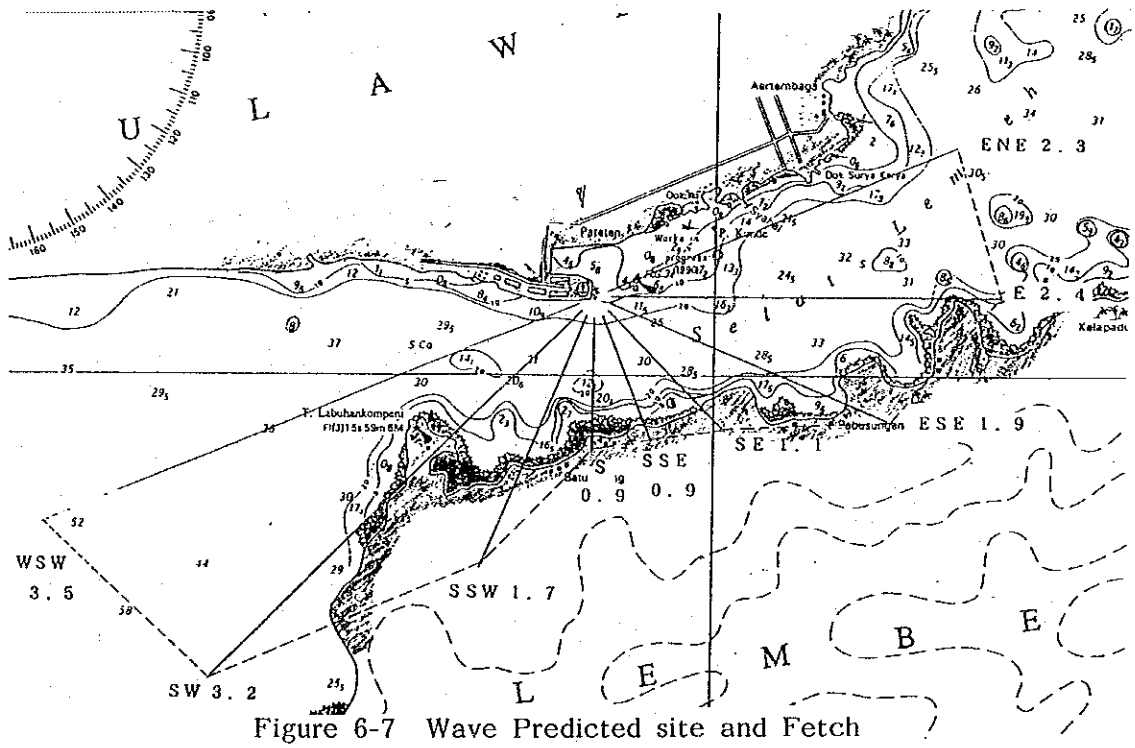


Figure 6-7 Wave Predicted site and Fetch

Table 6-2 Occurrence of Wave

Wind data ; Jan.1991 to Dec.1991
Observed ; 8760

Direction / Wave height(m)		ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	Total
0.00～ 0.09	No.										
	%										
0.10～ 0.19	No.	463	179	16	19	7	9	113	506	213	1,525
	%	5.3	2.0	0.2	0.2	0.1	0.1	1.3	5.8	2.4	17.4
0.20～ 0.29	No.	445	120		5			147	588	91	1,396
	%	5.1	1.4		0.1			1.7	6.7	1.0	15.9
0.30～ 0.39	No.	89	26		1			48	212	12	388
	%	1.0	0.3		0			0.6	2.4	0.1	4.4
0.40～ 0.49	No.		1						62		64
	%		0						0.7		0.7
0.50～ 0.59	No.								8		8
	%								0.1		0.1
0.60～ 0.69	No.										
	%										
0.70～ 0.79	No.										
	%										
Total	No.	998	326	16	25	7	9	308	1,376	316	3,381
	%	11.4	3.7	0.2	0.3	0.1	0.1	3.5	15.7	3.6	38.6

Calm 5379(61.4%)
Nonrecord 0(0%)

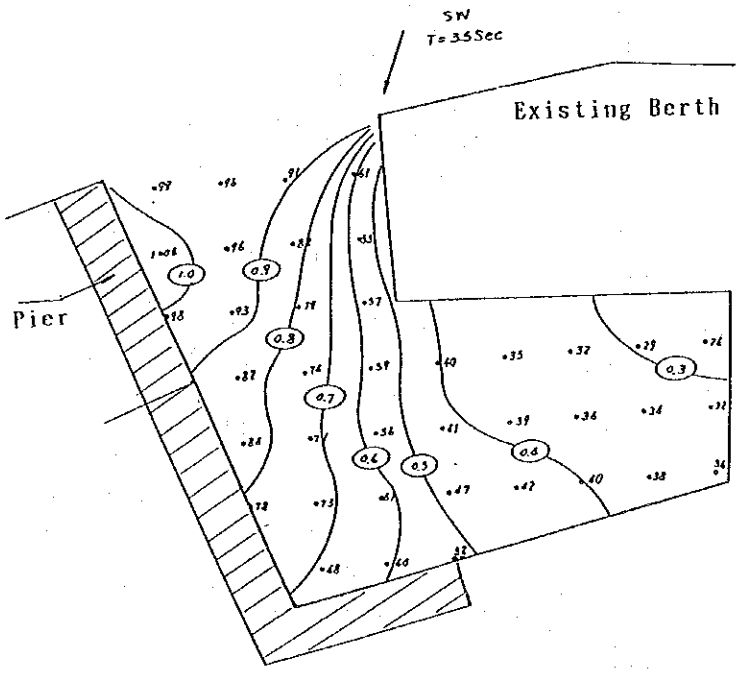


Figure 6-8 Wave height ratio in Basin

I. Cargo Handling Equipment and Working Vessels

127. The Specialized Container Berth at the port of Bitung is expected to handle about 40,000 TEUs of containers in the year 2000. There is no excess capability for container handling at the port. Therefore, it is necessary for the port to acquire equipment to handle the said amount of containers efficiently.

128. The new Bulk Cement Berth will accommodate cement tankers with 5,000 DWT, and five working days will be needed to unload the bulk cement from a vessel. A specialized cement unloader will be installed at the berth in order to achieve the expected unloading efficiency. As this unloader will be exclusively utilized by Semen Tonasa, procurement cost of this equipment is excluded from the project cost in this present study.

129. In the planning of container handling equipment, it is important to consider the whole cycle of container handling and storing at the container terminal.

130. The first decision that must be made concerns the capabilities and efficiencies of the equipment for loading and unloading cargo. It should be noted that container transportation at the port of Bitung in 2000 will still remain in the early stage of development although rapid traffic growth can be expected.

131. Containers will be transported to/from the port of Bitung by full-container and semi-container vessels with ship gears. Considering the planned number of TEUs at the berth, it is difficult to economically justify the installation of a container gantry crane for loading/unloading containers between a ship and the quay. It is generally said that the critical level for a single berth container terminal with a gantry crane is about 60,000 containers a year.

132. Observed container handling efficiency using a ship gear was sometimes in the neighborhood of 5 to 6 boxes per hour, which is considerably below the required efficiency. Therefore, it is necessary to prepare mobile cranes at the quay side in the terminal. The mobile cranes can be used to load and unload containers on ships and also to handle heavy loads in the terminal cargo handling areas.

133. The jib should be hinged sufficiently high to clear containers stacked on deck and to handle containers of all rows without any need to change on board. Container handling efficiency of a mobile crane is comparable to or a little less than that of a gantry crane.

134. The second decision concerns the selection of equipment for cargo handling areas. The work can be divided into three phases:

(a) Horizontal carriage of cargo
(b) Storage and stacking
(c) Delivery to and reception from shore transport

135. There are many kinds of equipment which can be used to move cargo horizontally such as trailers, front lift truck, side loader truck, carrier truck, reach stacker crane, mobile portal crane, straddle carrier, rubber tired and rail mounted gantries. Except the trailer and rubber tired or rail mounted gantry, all of the above machines can undertake stacking also.

136. In the case of machines combining moving and lifting, attention should be paid to their characteristics and efficient use; combination of trailer plus front lift truck is the most used initially, trailer plus reach stacker crane is gaining ground, and trailer plus straddle carrier is the most sophisticated and expensive.

137. Considering the volume of container traffic at the target year and versatility of equipment, following machines can be proposed to handle containers and heavy duty cargo at the special container berth and terminal.

(a)	Container handling mobile crane (35t)	1 unit
	(50t)	1 unit
(b)	Tractor units (tug master)	3
(c)	12m trailers	3
(d)	Reach stacker crane (top lifter)(35t)	1
(e)	Forklift trucks for vanning/devanning(2t)	2
(f)	Forklift trucks for empty container (10t)	1

138. In addition, procurement of the following floating crafts is recommended to secure safety and efficiency of the port operation:

(a)	Tug	(2 x 750 HP)	1 unit
(b)	Mooring boat	(2 x 80 HP)	1
	Pilot boat	(2 x 200 HP)	1

J. Direction for Further Development

139. As discussed in Section D of Chapter 6, Bitung East is regarded as the most suitable site for port facility development up to 2000, and the development plan of the port of Bitung in this study is proposed at this site.

140. The forecast volume of container traffic at the port of Bitung is 51,200 TEUs in 2000, and most of it will be handled at the specialized container berth, structural foundation of which is capable of future installation of a gantry crane.

141. The container traffic will increase year by year with the increase of economic activities in the hinterland, and a day will come when realized traffic exceeds the capacity of the proposed container berth. Then, additional container berths with gantry cranes should be constructed.

142. Suitable site for the container terminal after 2000 is the area adjacent to the proposed container berth, which is located between the Chemical Based Industry Wharf and the Ferry Jetty. Dredging will be required to get sufficient water depth to accommodate oceangoing container vessels, and the dredged materials will be utilized for the reclamation materials. There is space for the construction of an additional two container berths and container yard.

143. It will be very difficult, however, to find suitable sites along the coast of the Sulawesi Island side for the expansion of port facilities after the container terminal at the proposed site is saturated. Expansion to the east is impossible unless the Ferry Jetty moves elsewhere, and expansion to the west requires relocation of the Pertamina facilities somewhere.

144. Suggested site for the further development of the port of Bitung is Lembeh, the location of which is shown in Figure 6-3. Lembeh is a small island, located at the east of the Sulawesi Island and scarcely populated. Photo 6-1 shows a portion of the coastline of the Lembeh Island.

145. The water area along the west coast of the Lembeh Island is sufficiently calm for port operation because the island functions as a breakwater to protect the basin from waves. Furthermore, some portions of the west coastline of the Lembeh Island are flat so that the construction of new port facilities is possible in this area.

146. This site is considered to have relatively good natural conditions for port construction, and less social or economic friction can be expected in the port construction and operation because both social and economic activities are relatively thin in this area.

147. The greatest disadvantage of this site for port construction and operation lies in the problems of land transportation. The Lembeh Island is separated from the Sulawesi Island by Lembeh Strait which is 600 m wide at the narrowest points. It is said that a study to construct a bridge will begin in 1994/1995 in order to overcome transportation problems in Lembeh Island.

148. After land transportation problems are solved, Lembeh Island can be best utilized as a distribution or transshipment center for bulky cargo rather than general cargo, and it is also suited for shipbuilding activities. Development of this site as a distribution and industrial center will invite relocation of some of the existing industries along the coastline of Sulawesi Island to this site, thus activating the economies and reorganizing land use of downtown Bitung. The long-term development plan of municipality of Bitung clearly shows its intention to realize this direction.

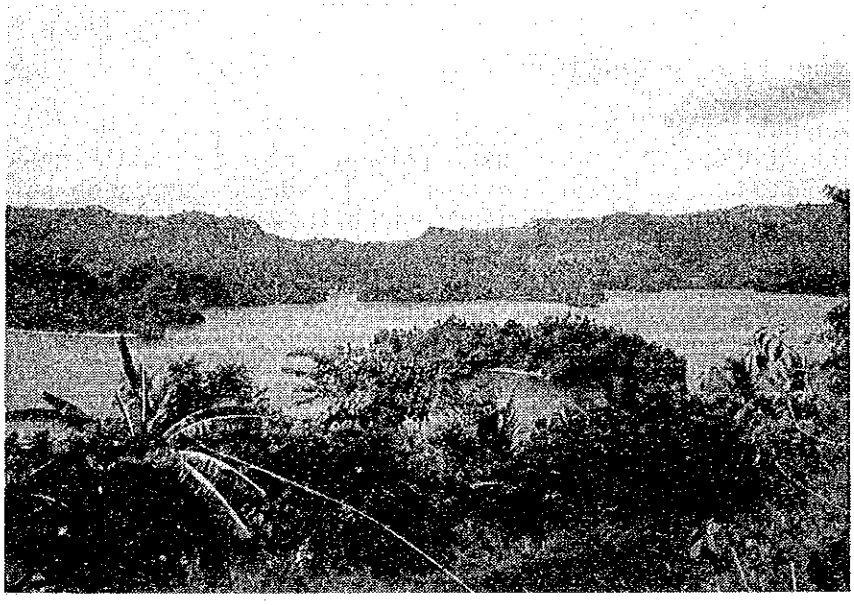


Photo 6-1 Lembeh Island

Chapter 7 DESIGN OF THE MAJOR PORT STRUCTURE

A. Basic Design Principles

Points to be considered in design

1. In the master plan for development of Bitung Port, the major port structure is proposed to function as multi-purpose wharf for the present and as a container wharf in future to cope with the possible increase in handling volume of container cargos. The wharf should be of a rigid structure which can bear the load of a variety of cargo handling equipment including gantry cranes of large capacity to be installed in futures and the load of vehicles carrying heavy equipment.

2. Bitung area is within the Seismic Zone II with earthquake factor of 0.09g, and seabed foundation in the port area is composed of loose sandy layers which may cause the differential foundation settlement in case that large-capacity gantry cranes are installed on the proposed port structure. Accordingly, the proposed port structure should be of an earthquake-resistant type and so designed as to prevent the foundation settlement.

3. Container terminal is planned to be constructed at the offshore site reclaimed by dumping land soils on the loose sandy seabed layers. Countermeasures should be taken for the foundation settlement of the container terminal.

4. Wharf accessories, such as fenders and bollards, should be so arranged as to accommodate a variety of calling ships and to enable the multi-purpose wharf to discharge its multi-functions, taking into consideration the service area of the cargo handling equipment on the wharf.

Points to be considered in selection of construction method

5. The Lembeh Strait reduces its width around the port area of Bitung, and the ships navigating through the strait use a coastal route near the port. The major port structure should be so constructed as to provide no hindrance to the navigating ships and to the cargo handling activities at the existing wharves.

6. Locally produced materials should be used in the construction works to the maximum extent, and the construction method that is widely adopted and ensures the early completion of the works should be selected. Selection of such a construction method that requires special technique or special constructional plant should be avoided in any case.

7. To minimize the offshore works which are likely to delay the construction works, precast members manufactured on land should be used to the maximum extent and the construction works should proceed from the shore to the offshore direction.

8. Due attention should be paid to the environmental aspect and proper countermeasures should be taken to avoid sea water pollution by effluence of filling materials from the reclaimed area and waste oil from the floating equipment used during the construction works.

B. Port Facilities to be Designed

Specialized container berth

9. Facilities to be included in the container terminal are as follows:

Specialized Container Berth:	Main pier Side pier
Container yard:	Container yard Roadways of the terminal CFS Revetment Access road Parking area

10. Figure 7-1 shows the main pier (130 m in length, depth alongside -7.5 m) of Specialized Container Berth. The pier allows a 5,000 DWT class container ship to directly berth. A gantry crane (30.5t) will be installed on it in future and moreover the surface area is utilized for passage of such heavy equipment as 35t to 50t mobile cranes to perform cargo-handling works from the pier side. Pier width is 40 m, the forward half (20m) of which is separately used for crane passage and for apron while the rear half is commonly used for the marshaling yard and apron.

11. The side pier which will be used as a part of the container yard forms a connecting section between Bulk Cement Berth and Specialized Container Berth and thus the depth alongside is the same as these two berths, i.e. -7.5m.

12. The stacking yard will occupy the main part of the container yard. The stacking yard will be provided under the classification by stuffed containers, empty containers and reefer containers.

13. The roadways of the terminal will be built such that they connect the pier, stacking yard, CFS, office and other facilities effectively in the terminal. The CFS (Container Freight Station) is a building where contents of containers will be sorted.

14. Revetments should be constructed along the periphery of the reclaimed land section as well as along the retaining area located in the back of the pier.

15. Access roads will be constructed in the port area and will link the terminal with the urban districts.

Bulk cement berth

16. Facilities to be included in the cement berth are as follows:

Bulk Cement Berth:	Main pier
Yard:	Revetment Access road

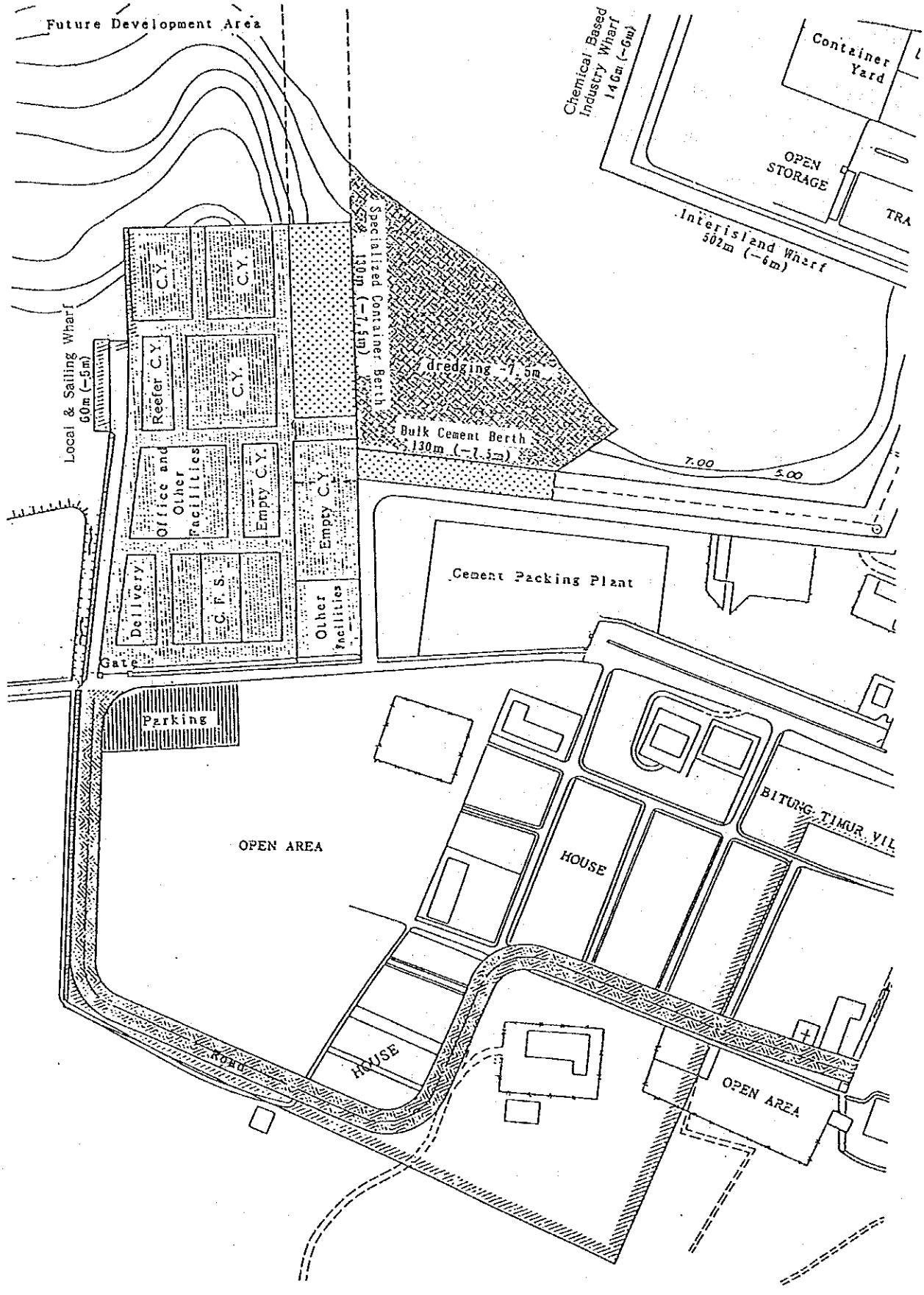


Figure 7-1 Arrangement of Port Facilities

17. The main pier of Bulk Cement Berth will allow a 5,000 DWT class cement bulk carrier to directly berth alongside. Depth alongside is -7.5m and length 130m. The 20m wide pier is used for an apron.

18. A packing plant is planned to be constructed in the yard by a cement company intending to start local production and thus the roadways of the terminal are to be refurbished in such a way that free entry and exit to and from the existing port area will become possible.

19. The access roads will be used for the passageways from the cement berth to the urban districts.

C. Selection of Structural Types

Specialized Container Berth

20. In general, the Caisson type, vertical wall type that uses steel sheet piles, and pier type in which the apron is supported by pile foundation represent the typical structure of the container berths.

21. A gantry crane (hoisting capacity: 30.5t) will be installed on the planned container berth in future and moreover such heavy equipment as 50t mobile crane, 35t top lifter, etc. travel over the apron. The geological feature of the berth construction site is such that a loose sand bed extends from the seabed down to a depth of -40m and thus the bearing layer is very deep.

22. By taking into account those conditions, it was concluded that the pier type with pile foundations is the most suitable type for the berth structure in that it can support cranes firmly and moreover preclude the occurrence of uneven settlement.

23. The pier type is also effective as a buffer against the waves because of the sloped seabed underneath it formed by the embankment having surface armor stones. The berth construction site area will become a basin in the future, but it is foreseeable that the inside waters may sometimes be disturbed and reduce in calmness depending upon the type of invading waves and resultant influences caused by the reflected waves.

24. Figure 7-2 shows the influences to be exerted on the planned site by the invading waves (SSW) in terms of wave height ratio. As shown in the Figure, the vertical wall type will much amplify the waves as compared to the present condition while the pier type does only slightly.

25. After due consideration given to these points, the pier type was finally selected as the most suitable berth type for this plan.

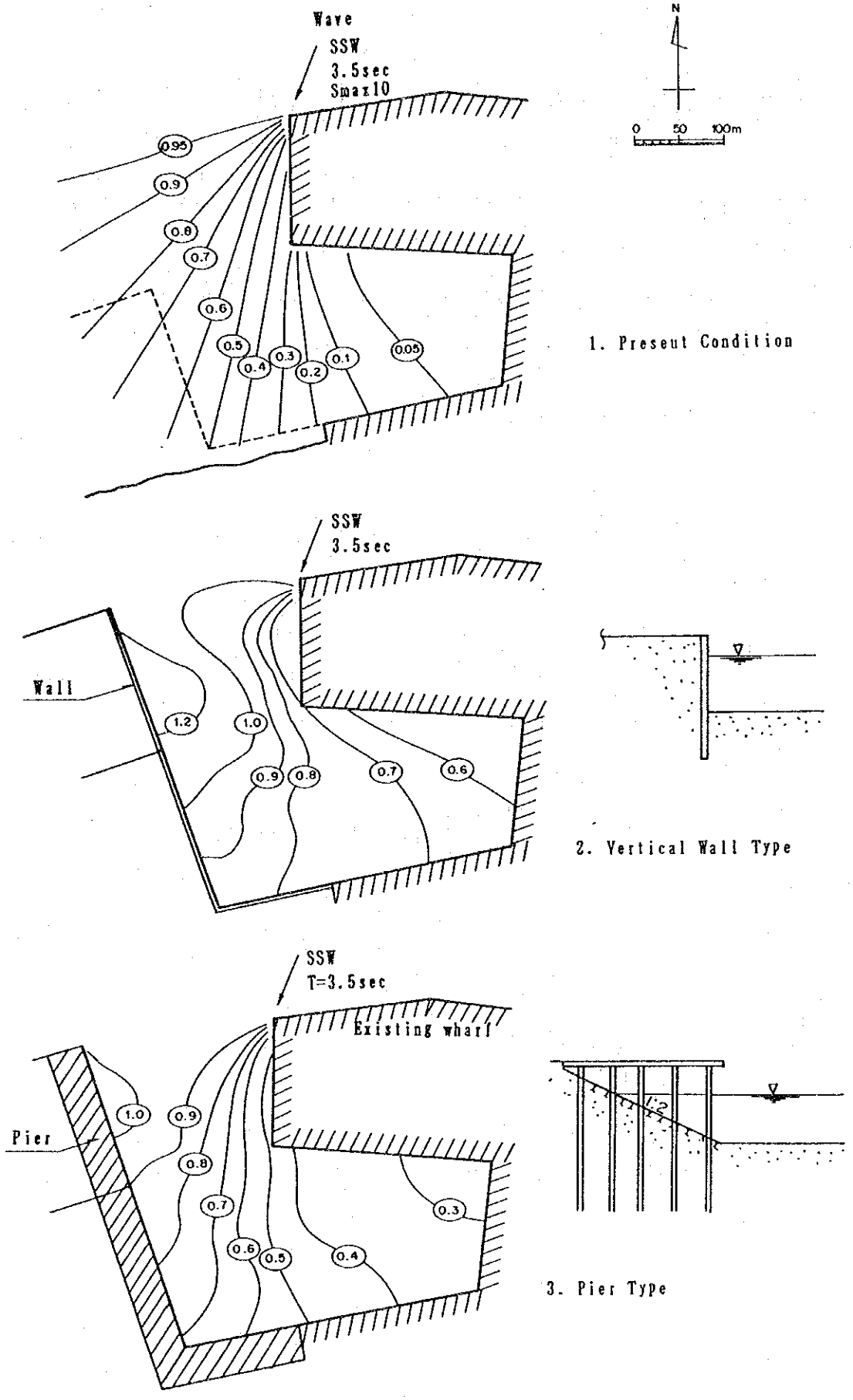


Figure 7-2 Wave Height Ratio

Bulk Cement Berth

26. The Bulk Cement Berth will be used primarily for loading the powdered cement and pneumatic type cargo-handling equipment will be installed. In addition, since bagged cement will also be shipped, the traffic of large-size forklifts and mobile cranes are also expected.

27. Accordingly, the pier type is considered the most suitable type for the cement berth as for the container berth with a view to having a rigid apron structure. In addition, this type is again adequate for maintaining the calmness of the basin.

D. Design Conditions

Tide level and water depth

28. The tidal level at Bitung Port is as follows:

High water level: +1.90m

Low water level: ±0.00m

29. The water depth alongside Specialized Container and Bulk Cement Berths are taken as shown below:

	Original seabed (m)	Required depth (m)	Design depth (m)
Specialized Container Berth	-2.5 to -6.8	-7.5	-8.0 ~ -10.5
Bulk Cement Berth	-2.0	-7.5	-8.0

It is noted that the depth alongside at the southern end of Specialized Container Berth is increased in advance in order to match the expected future depth at the time of extension.

Berth elevation

30. The berth elevation is taken as +3.00m in accordance with the Design Criteria of DGSC, which is obtained by adding an estimated additional height of 1.1m to the tidal range of 1.9m at Bitung Port. This berth elevation is the same as the existing berths.

Soil condition

31. The seabed geological composition and soil properties of each berth site are as shown below:

Specialized Container Berth		Bulk Cement Berth	
-2.5 ~ 6.8m	Original seabed Sand with coral (Medium dense) N-value;5~15 $\bar{N}$=10	-2.0m	Original seabed -2.0m Sand (Medium) N;5~15 $\bar{N}$=10
-16.0m	Silty Sand (Medium) N;5~10 $\bar{N}$=7	-12.0m	Silty Sand N;5~15 $\bar{N}$=10
-34.0m	Sand (Dense) N;10~30 $\bar{N}$;20	-18.0m	Sand (Dense) N;10~30 $\bar{N}$=20
-40.0m	Sand (Very dense) N>50	-28.0m	Sand (Very dense) N>50

Ship dimension

32. The berth should be able to accommodate a 5,000 DWT class ships

Length (OA):	108.0m
Breadth (mld):	17.0m
Depth:	8.5m
Draft (mld):	6.5m
Displacement:	7,900 tons

Design load

33. The seismic coefficient is taken as follows in accordance with the Design Criteria of DGSC.

Regional seismic coefficient: 0.09
(Bitung Port: Zone II, soft soil)

Coefficient of importance: 1.5

Design seismic coefficient k = 0.09 x 1.5 = 0.15

34. Uniform load is taken for 3.0 t/m^2 which will be imposed on the surface of the pier in accordance with Specialized Container Berth, of the Design Criteria. At the time of earthquake, it is taken for about 50% to 1.5 t/m^2.

35. Live load is taken as follows based on the planned cargo-handling equipment:

(1) Specialized Container Berth

Container Crane (In future)	30.5t 32 wheels	dead weight 550t max. 29.6t per wheel
Mobile Crane	50t Hoist	max. 50t per outrigger
Top Lifter	35t	max. 46t per wheel

(2) Bulk Cement Berth

Truck Load max. 10t per wheel

36. Load to be imposed on the container yard is taken as follows:

Stuffed container: three-high stacking Wc = 4.0 t/m^2

37. Berthing velocity of ship

For the berthing velocity of a 5,000 DWT class ship, V = 15 cm/sec is taken.

Design criteria and conditions

38. The following are the design criteria and conditions to be considered in designing the major port structure:

(a) Standard Design Criteria for Ports in Indonesia published by the Directorate General of Sea Communications, Ministry of Communications;

(b) Peraturan Beton Bertulang Indonesia 1971 (Indonesian Regulations Concerning Reinforced Concrete 1971) published by the Directorate General of Works Development, Ministry of Public Works and Electric Power;

(c) Peraturan Perencanaan Bangunan Baja Indonesia 1984 (Indonesian Regulations Concerning Steel Structure Planning 1984) published by the Institute of Construction Problems Investigation;

(d) Peraturan Muatan Indonesia 1970 (Indonesian Regulations Concerning Loading 1970) published by the Directorate General of Works Development, Ministry of Public Works and Electric Power;

(e) Peraturan Perencanaan Geometrik Jalan Raya (Indonesian Regulations Concerning Geometric Planning of Highways) published by the Directorate General of Highways, Ministry of Public works;

(f) Technical Standards for Port and Harbour Facilities in Japan, 1980, published by Bureau of Ports and Harbour, Ministry of Transport.

E. Preliminary Design of the Port Facilities

Specialized Container Berth

39. Figure 7-3 shows the standard cross section of the main pier of Specialized Container Berth. The foundation of the main pier is composed of coupled PC piles in consideration of the seismic load while for the crane foundation, vertical piles will be used. All these piles will be fully driven so that each pile toe reaches a compact sand bed located at a depth of -40m.

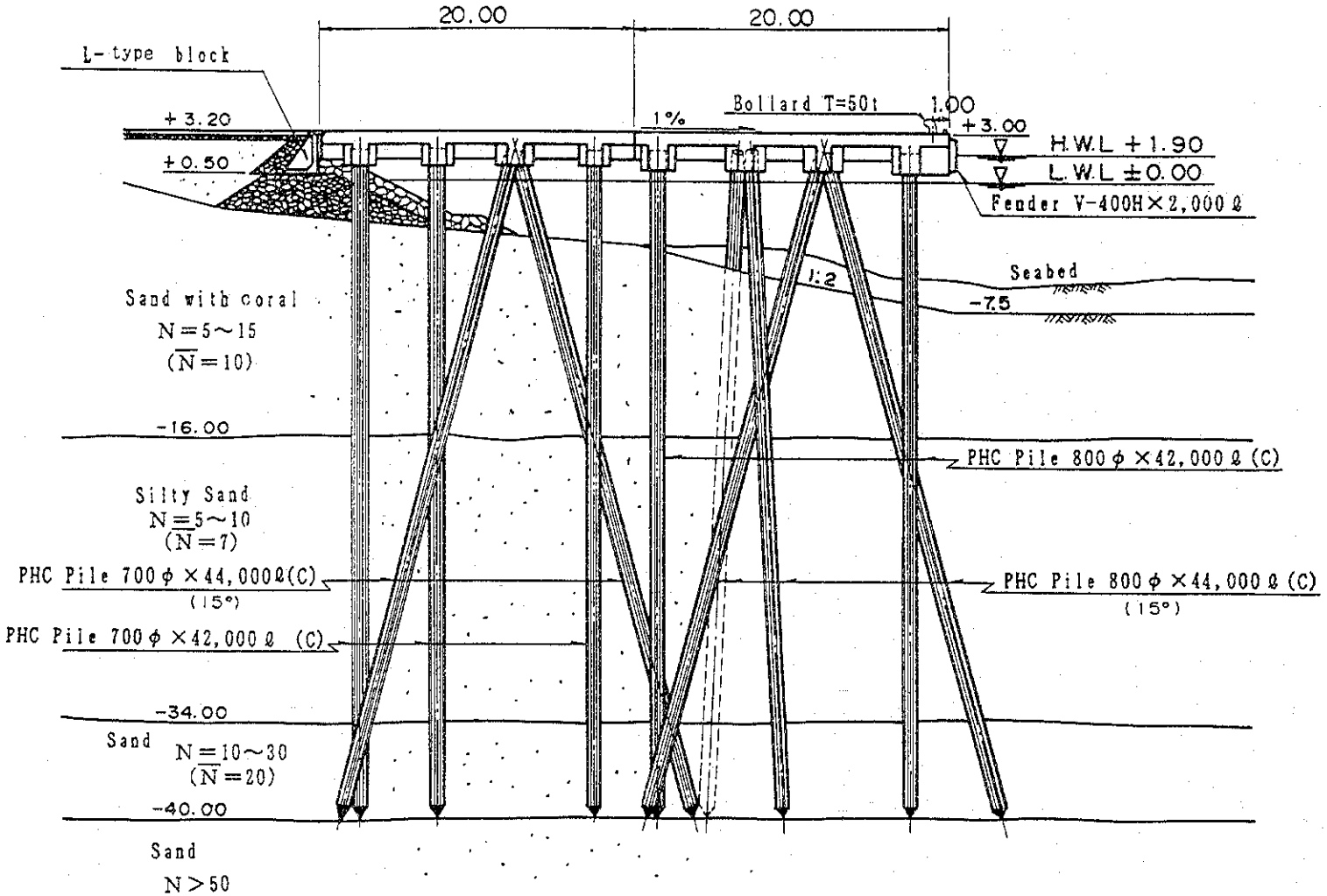


Figure 7-3 Standard Cross Section of Main Pier of Specialized Container Berth

40. Regarding the foundation pile, a comparison was made between P.C. pile and steel pipe pile. The result shows that the P.C. pile is advantageous to the steel pipe pile in respect of construction costs.

41. The reinforced concrete will be used for the coping concrete which is to be placed in situ. The surface of it is coated with the concrete pavement with a slope of 1%.

42. An embankment with a slope of 1:2 should be constructed underneath the pier to buffer the reflection of the waves.

43. The retaining revetment in the rear of the pier will be constructed by transporting by sea the L type blocks prefabricated on the land and installing them at the site. The slopeface should be protected by armor stones.

44. As shown in Figure 7-4, the stone masonry revetment will be used for the reclamation revetment of the container yard.

45. Figure 7-5 shows the access road having two lanes, each 6m wide, with a center strip and sidewalks. The total overall width is 17m, pavement of the container yard will be as shown in the Figure.

Bulk Cement Berth

46. Figure 7-6 shows the standard cross section of Bulk Cement Berth. Its structure is the same as the pier of Specialized Container Berth.

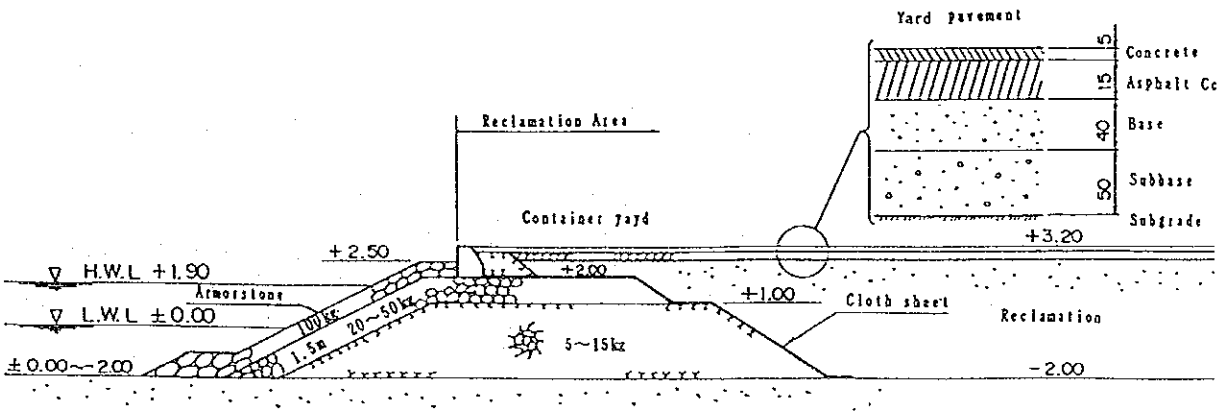


Figure 7-4 Section of Revetment and Container Yard

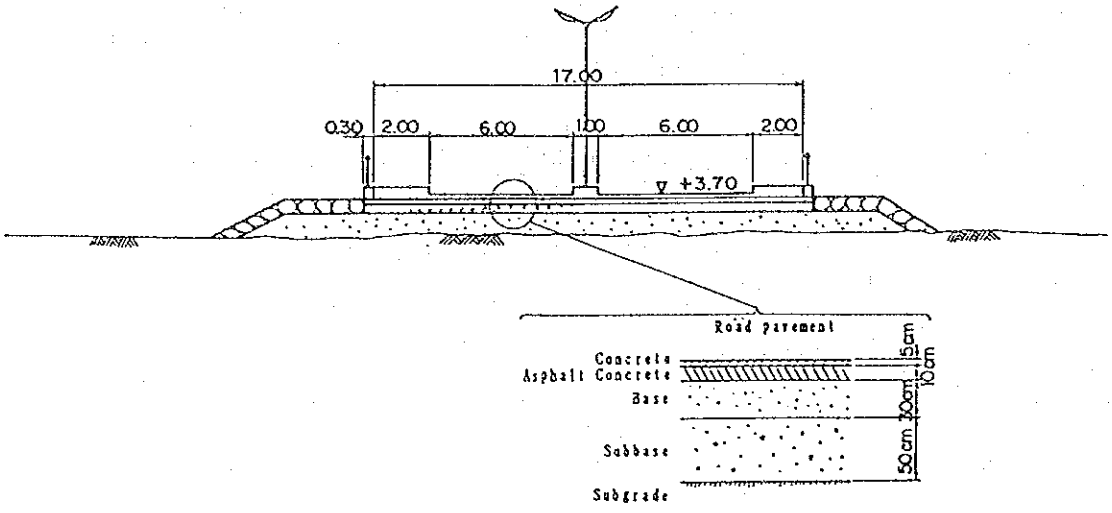


Figure 7-5 Section of Access road

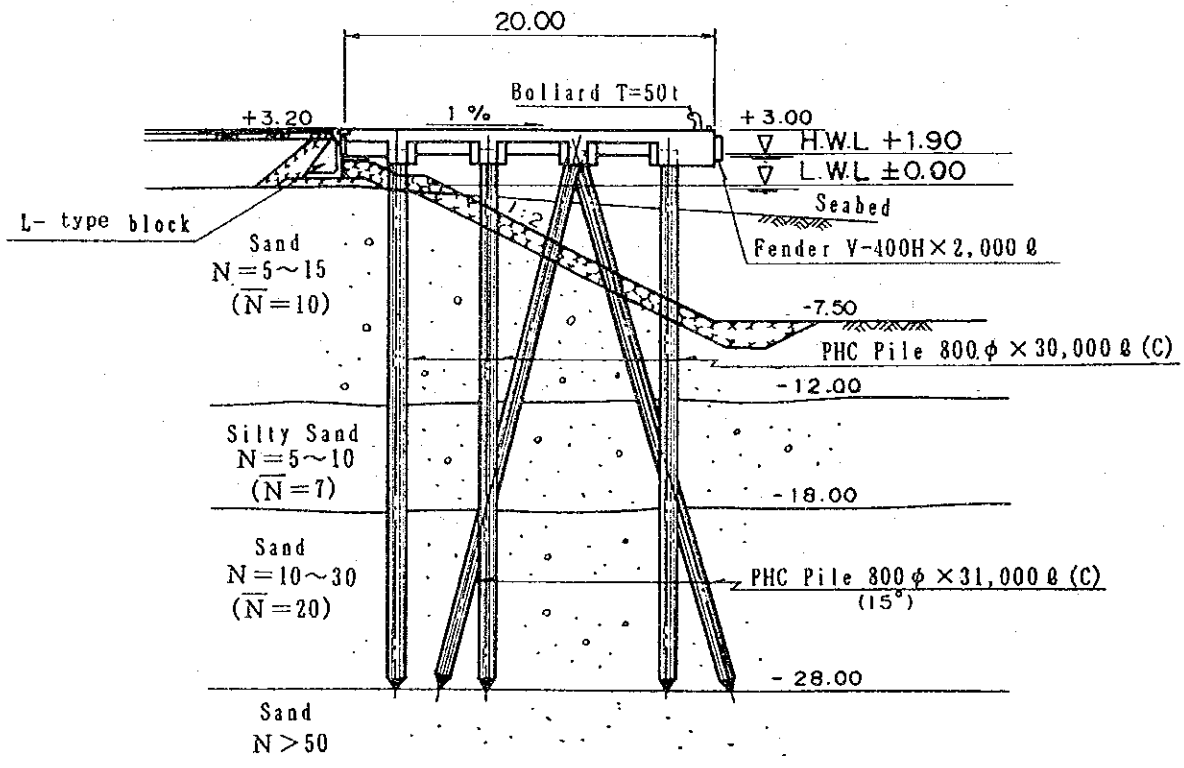


Figure 7-6 Standard Cross Section of Bulk Cement Berth

Chapter 8 COST ESTIMATE AND CONSTRUCTION SCHEDULE

A. Basic Conditions for Cost Estimation

1. Basic prices of materials, labor, work crafts, equipment to be used for estimation of the construction cost are those obtained by the JICA survey team in December, 1992, and adjusted to reflect subsequent price hikes.

2. To adjust the basic prices, the price list published in Jakarta in July, 1993 and that published in the Province of North Sulawesi are used and moreover reference is made to the unit prices used for construction cost estimates for the Semarang Port container terminal in the Province Central Java. Accordingly, the basic unit prices are as of May, 1993.

3. The construction cost is divided into the local currency protion and the foreign currency portion. The applicable currency exchange rates are taken as follows:

US$1.00 = Rp2,083 = ¥105.47 (¥1 = Rp19.75)

4. For the physical contingency, ten percent (10%) for the local currency portion and five percent (5%) for the foreign currency portion are allowed in respect of the direct costs of the civil and building works as well as the total procurement costs of cargo-handling equipment and craft, cost of engineering service.

5. For the cost of engineering service (detail design and supervision), ten percent (10%) of the direct cost of the civil and building works is allowed and is divided into thirty percent (30%) for the local currency portion and seventy percent (70%) for the foreign currency portion.

6. Value Added Tax (VAT) is indicated in the amount equivalent to ten percent (10%) of the sum of the direct cost of civil and building works, equipment procurement cost, craft cost, physical contingency and engineering service fee.

7. The rise in prices in future is not taken into consideration.

B. Result of the Cost Estimation

Basic price

8. The basic prices and hiring charges for construction equipment used for the cost estimation are shown in Appendix 8-1. In the Appendix, (1) shows unit costs of labor charge, (2) major materials, and (3) construction equipment hiring charges per day.

9. Import items that represent the foreign currency part are shown in (4) of the Appendix. The prices of these import items are the CIF Jakarta prices which are inclusive of roughly estimated import duties.

10. Method of cost estimation is based on the following Standard.

- Cost Estimation Standard for Civil Works for Construction of Port Facilities compiled by the Bureau of Ports and Harbours, Ministry of Transport Japanese Government.

- Analisa Upah dan Bahan (Labor Wage and Material Cost Analysis).

11. Table 8-1, 8-2 show the details of the cost estimation. From the Table the following is known.

Specialized Container Berth: Rp 52,197 million

Bulk Cement Berth : Rp 20,520 million

C. Preliminary Study of Construction Procedure

Specialized Container Berth

12. High quality PC piles are planned to be used for the pile foundations of the pier of Specialized Container Berth. Since the bearing layer of the foundation ground is located at a depth -40m, three 15m PC piles are to be spliced in order to reach it. The driving capacity to drive such long piles will constitute the critical path of the pier construction works.

13. As for the piling, it is estimated that three vertical piles and one and half batter piles will be driven every day. Accordingly, it takes 240 days, or about eight months to drive all 224 batter piles and 272 vertical piles. Due consideration should be given to the concrete work of superstructure so that it can be started as soon as all piling in each block of 20m x 20m is completed.

14. Construction of the revetment along the periphery of the reclaimed land area will be done by spreading rubble from the land side. In this case, it is also necessary to spread rubble from the ship but only at the off shore side of the reclaimed land area in order to shorten the work period.

15. Reclamation is planned to be used for the materials from land. However, since it will increase frequency of land transportation, it is necessary to utilize the dredged materials from the sea as well.

16. Since heavy cargoes will be stacked on the container yard, it should be paved with asphalt concrete after the loose foundation ground is well compacted.

17. The access road should be constructed firmly after the site is well prepared so as to ensure unobstructed passage of heavy duty vehicular traffic.

Bulk Cement Berth

18. A masonry revetment is stands on Bulk Cement Berth side. This masonry revetment should be removed at the time of dredging of the front water for the successive foundation pile driving. It is important to carry out dredging beforehand.

Table 8-1 Construction Cost of Specialized Container Berth

unit : million Rupia

Construction Item	Works	Quantity	unit	Total			1st year			2nd year			3rd year		
				Cost	LC	FC	Cost	LC	FC	Cost	LC	FC	Cost	LC	FC
I. Direct Cost				31,823.1	20,514.7	11,308.4				26,046.9	15,149.8	10,897.1	5,776.2	5,364.9	411.3
I-1.Mobilization and Preparation		1	L	700.0	700.0	–				700.0	700.0				
I-2.Dredging		43,000	m³	507.4	507.4	–				507.4	507.4				
I-3.Reclamation	Revetment	400	m	1,889.6	1,889.6	–				1,889.6	1,889.6				
	Reclamation	62,000	m²	612.4	612.4	–				612.4	612.4				
I-4 Specialized Container Berth	Main Pier	5,200	m²	20,170.0	9,796.0	10,374.0				20,170.0	9,796.0	10,374.0			
	Side Pier	1,600	m²	2,167.5	1,644.4	523.1				2,167.5	1,644.4	523.1			
	Container Yard	37,000	m²	2,313.6	2,313.6								2,313.6	2,313.6	
	Miscellaneous	1	L	2,129.5	1,718.2	411.3							2,129.5	1,718.2	411.3
	Road	486	m	1,333.1	1,333.1								1,333.1	1,333.1	
II. Equipment and Craft		1	L	8,974.2	3,999.5	4,974.7							8,974.2	3,999.5	4,974.7
III. Engineering and Supervision		1	L	3,182.3	954.7	2,227.6	1,591.1	477.3	1,113.8	795.6	238.7	556.9	795.6	238.7	556.9
IV. Physical Contingency		1	L	3,472.3	2,546.8	925.5	103.4	47.7	55.7	2,111.5	1,538,8	572.7	1,257.4	960.3	297.1
V. VAT		1	L	4,745.2	4,745.2		169.5	169.5		2,895.4	2,895.4		1,680.3	1,680.3	
Grand Total				52,197.2	32,761.0	19,436.2	1,864.0	694.5	1,169.5	31,849.4	19,822.7	12,026.7	18,483.7	12,243.7	6,240.0

Table 8-2 Construction Cost of Bulk Cement Berth

unit ; million Rupia

Construction Item	Works	Quantity	unit	Total			1st year			2nd year			3rd year		
				Cost	LC	FC	Cost	LC	FC	Cost	LC	FC	Cost	LC	FC
I. Direct Cost				12,520.9	8,642.5	3,878.4				9,056.1	5,589.0	3,467.1	3,464.8	3,053.5	411.3
I-1. Mobilization and Preparation		1	L	700.0	700.0					700.0	700.0				
I-2. Dredging		43,000	m³	507.4	507.4					507.4	507.4				
I-3. Revetment	Revetment	150	m	809.8	809.8					809.8	809.8				
I-4. Bulk Cement Berth	Main Pier	2,600	m²	7,038.9	3,571.8	3,467.1				7,038.9	3,571.8	3,467.1			
	Yard	28,000	m²	253.9	253.9								253.9	253.9	
	Miscellaneous	1	L	988.6	577.3	411.3							988.6	577.3	411.3
	Road	324	m	2,222.3	2,222.3								2,222.3	2,222.3	
II. Craft		1	L	3,402.5	3,402.5								3,402.5	3,402.5	
III. Engineering and Supervision		1	L	1,252.0	375.6	876.4	626.0	187.8	438.2	313.0	93.9	219.1	313.0	93.9	219.1
IV. Physical Contingency		1	L	1,479.8	1,242.1	237.7	40.7	18.8	21.9	752.6	568.3	184.3	686.5	655.0	31.5
V. VAT		1	L	1,865.6	1,865.6		66.7	66.7		1,012.2	1,012.2		786.7	786.7	
Grand Total				20,520.8	15,528.3	4,992.5	733.4	273.3	460.1	11,133.9	7,263.4	3,870.5	8,653.5	7,991.6	661.9

19. As for the existing berth located adjacent to Bulk Cement Berth, its apron is planned to be widened. Hence, due consideration should be given to the construction schedule so that it may include the construction of the roadways in the rear.

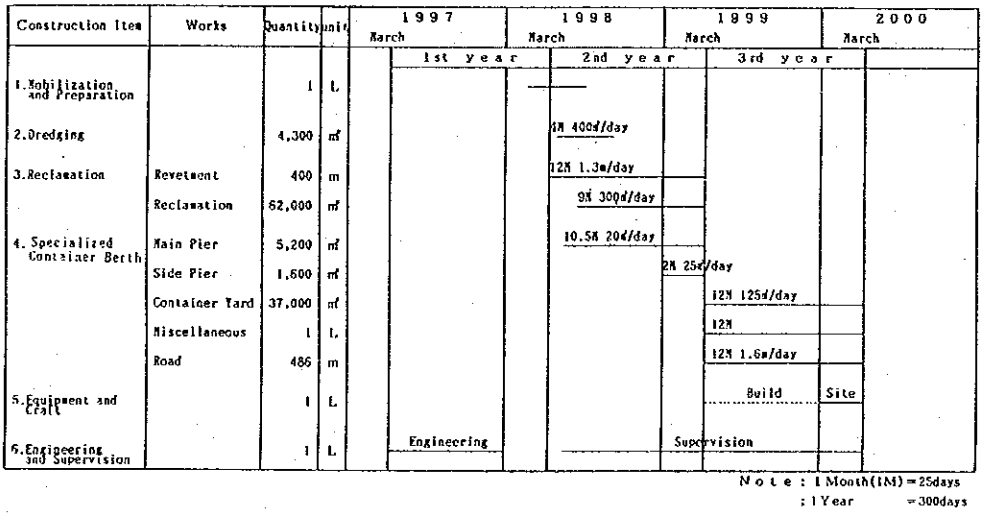
D. Construction schedule

20. The planned construction site is extremely calm among other places in the Bitung Port and thus the construction schedule can hardly be expected to be obstructed by natural conditions.

According to the estimated construction schedule, it takes two years of each to complete the container berth and cement berth respectively.

21. Figure 8-1 shows the construction schedule of Specialized Container Berth and Bulk Cement Berth. As is known from the Figure, the first year will be devoted to engineering service and administrative procedure and thus the construction works are to be executed in the second and third years. The progress of the works will be such that the pier will be constructed in the starting year of the construction works and the yard and roads in the following year.

(1) Specialized Container Berth



(2) Bulk Cement Berth

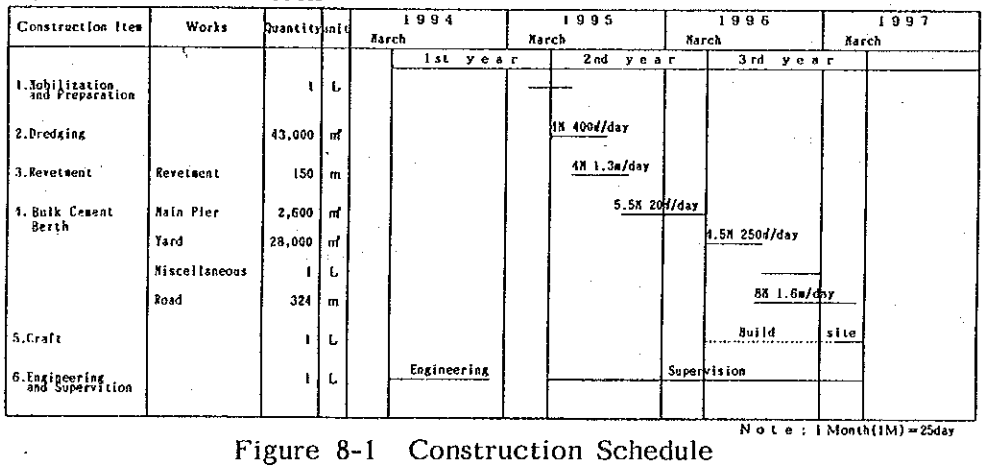


Figure 8-1 Construction Schedule

Chapter 9 ENVIRONMENTAL IMPACT ASSESSMENT

A. Basic Procedure of Environmental Impact Assessment

General

1. Environmental Impact Assessment (EIA) concerning the port development of Bitung is based on the following regulations in principle.

a) Government Regulation No.29, 1986 regarding the Analysis of Impact upon the Environment
b) Technical Guidance for Environmental Impact Analysis on Harbor Affairs (MOC, 1990)

2. Above regulations do not describe the detailed method of EIA regarding the feasibility study. Therefore, JICA study team adopts some of the international EIA technical guide-lines to this study.

3. In this study, JICA study team carried out the EIA according to the following stages.

a) Port construction stage
b) Port existence stage (Operations have not yet begun)
c) Port utilization stage

4. The assessment year of EIA in this study is 2000 (excluding Port construction stage) and the target area is as follows. The environmental impact source exist inside of the port area.

a) The land area is Bitung municipality
b) The water area is waterfront of Bitung municipality

Methodology of EIA

5. The EIA procedure in this study is shown in Figure 9-1. The summarized procedure of EIA is as follows.

a) Select the environmental impact elements by the port development and make the matrix of relation between the environmental impact elements and the environmental constituent factors.
b) Evaluate the present environmental condition using the existing data and results of field survey.
c) Establish the target of environmental preservation.
d) Estimate the change of the environmental constituent factors by the port development.
e) Investigate the countermeasures for environmental preservation.
f) Carry out the assessment by above conditions.

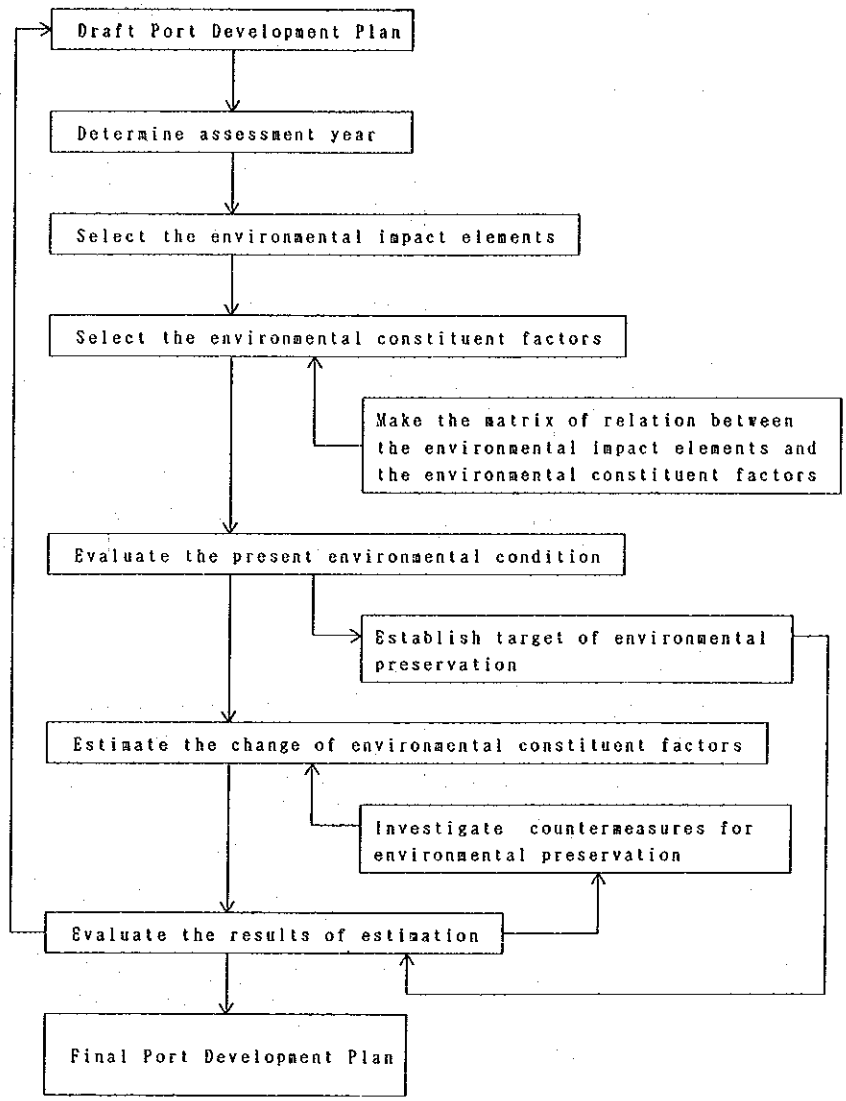


Figure 9-1 Flow-Chart of EIA

6. The relation between the environmental impact elements and the environmental constituent factors is shown in Table 9-1. According to this Table, the environmental impact assessment items were selected.

Table 9-1 Relationship between Environmental Impact Factors and Environmental Components

	Air Qty.	W/B cndns.	Nse/ Vibn.	Odor	Topo-graphy	Cstl Hyd	Fauna/ Flora	Scenic View	Wste	Scio-cltr.	Scio-econ.	Remarks
Construction works	o	o	o	o			o		o	o	o	
Existence of Port Facilities and Site		o			o	o	o	o		o	o	
Use of Water-area Facilities and Wharves	o	o			o		o		o		o	
Operation of Loading, Storage, Movable Facilities	o	o	o	o			o		o		o	
Operation of Facilities Handling Hazardous Wastes	o	o		o			o				o	
Operation of Waste Treatment and Disposal	o	o		o			o		o	o		
Traffic Functions	o		o				o			o	o	
Operation of Distribution and Storage Functions	o		o	o							o	

Note: Each environmental component has the following paticulars:

Air Qty = Air quality: sulfur oxides, nitrogen oxides, carbon monoxide, hydrocarbon, dust, fluoride and other hazardous objects

W cndns = Water condition: chemical oxygen demand(COD), nitrogen, phosphorus, dissolved oxygen, thermal discharge, grease, hazardous object, pH, suspended solid(SS)

B cndns = Bottom condition: COD, ignition loss, sulfide, hazardous objects

Nse/Vibn = Noise/Vibration: noise, vibration

Odor: hydrogen sulfide, methyl mercaptan, methyl sulfide, ammonia, methyl disulfide, trimethylamine, acetaldehyde, styrene

Topography: littoral drift, ground subsidence, groundwater hydrology

Cstl hyd = Coastal hydrology: waves, currents

Fauna and Flora: (aquatic) bacteria, plankton, weeds, attached organisms, benthic animals, coral, fishery resources, (terrestrial) birds on beaches, other animals and plants, mangroves

Scenic view: scenic view

Wste = Waste: municipal common wastes, industrial wastes

Scio-Cltr = Socio-culture: resettlement of residents, local population distribution, cultual assets (historical, religious, academic), racial composition, communication

Scio-Econ = Socio-economy: employment, fisheries, land use(agriculture, forestry, industry and mining), tertiary industry(including tourism, recreational facilities), local transport network, sanitation

7. Assessment method for this study was determined by the present environmental conditions around the port and the port development plan of this port. Based on the above conditions, "Impact Grasping Method" was applied as the assessment method in this study. This method tries to determine the magnitude of impacts of port development on the present environment in the hinterland in comparison with impacts from other causes. If the impact from the port development is determined to be small, then impacts of port development would not be subject to further examination.

8. In general, "Tidal current" and "Water quality" are the major environmental constituent factors likely to be affected by port development and reclamation. In this present study, therefore, computer simulation technique will be applied to investigate possible magnitude of environmental impact regarding these environmental constituent factors by the proposed port development project.

B. Impact Assessment of Construction Works

Presupposition of estimates

9. Based on the design of port structure, construction method and construction schedule which are described in Chapter 7 and 8, the impact assessment of construction works was carried out. The present socio-economic, natural and environmental conditions are based on Chapter 2 and 3.

10. There are little existing environmental monitoring data, in spite of the fact that the Indonesian government does have some regulations regarding the environment. Therefore, in this study, the target of environmental preservation was established as follows;

" The impact to environment will be permissibly small. "

Air quality

11. In general, the major pollutants generated by port construction works are dust and gases. The primary sources of dust are construction works and road traffic. Gas emissions are produced by work boats and construction machinery. Smoke, soot, fumes and vapors are also generated by work vessels.

12. Air pollution caused by construction works is a temporary impact during the construction period. In general, the scale of impact is smaller than that of industrial activities. The diffusion area of air pollutants caused by construction machinery is limited, because the altitude of the generation source regarding air pollution is low, so air pollutants are diffused and diluted by air current of the earth's surface. Therefore, it seems generally that the impact area stretches less than a hundred meters from the construction site.

13. In this case, the scale of construction works is not so large and the construction site is inside of the port area. Furthermore, the distance between the construction site and residential areas is more than two hundred meters. Based on the above conditions, it seems that the impact to the air quality will be limited, so air quality around Bitung port during the construction period will be the same as the present air quality.

Water quality

14. A major indicator of water pollution caused by construction works is Suspended Solid (SS). The primary sources of SS are dredging and reclamation work.

15. An increase of suspended solid caused by marine construction works depends on stirring bottom sediments and dumping soil. Thus the construction planning, the construction method and selection of construction machinery are very important for controlling an increase of suspended solid.

16. In this case, the scale of construction works is not so large. Therefore, the volume of suspended solid is limited and if silt protector is used in case of dredging, the diffusion of suspended solid is cut more than 50%. Furthermore, it is efficient for cutting the increase of suspended solid to start the reclamation work, after the shore protection is completed. On the other hand, the areas neighboring on the construction site are port, ferry terminal, shipbuilding yard and factories. So slight increase of suspended solid during the construction period will be permitted. Thus it seems that the impact to water quality around Bitung port during the construction period will be permissibly small.

Noise and vibration

17. Noise and vibration are public nuisances associated with construction works. The primary sources of noise and vibration are operation of work boats and construction machinery.

18. Noise and vibration caused by construction works are intermittent impact during the construction period. In general, it is said that the power level of major work boats and construction machinery is about 100 dB(A). The noise level declines in proportion to the distance from the source. Based on a logarithmic scale, a decline of half the sound energy is measured as a decline of 3 dB(A) on the scale. In case of a point source of noise, the noise level in dB(A) declines by 6 dB(A) at every double distance from the source. On the other hand, the vibration level also declines in proportion to the distance from the source. Generally speaking, in case of a point source of vibration, the vibration level in dB declines by 3 to 6 dB at every double distance from the source. (refer to Appendix 9-1)

19. In this case, the distance between the construction site (noise and vibration source) and residential areas is more than two hundred meters. According to an example of noise reduction at certain distances, if the generated noise level is 100 dB(A), the noise level at a distance of 20 m is 66 dB(A) in case of point noise source. (refer to Appendix 9-2) Furthermore, trees, fences, houses and similar obstacles are effective barriers against noise. Thus, it seems that the impact of noise around the Bitung port during the construction period will be small. Likewise, it seems that the impact of vibration also will be small.

Odor

20. In general, the substances causing stench are ammonia, methyl mercaptan, hydrogen sulfide, methyl sulfide, trimethyl amine, methyl bisulfide, acetaldehyde and styrene. The primary sources of them are dredging and dumped soil.

21. In this case, dredging and soil dumping will be carried out. But according to the soil condition data in the sea, above substances were not found. So it seems there will be no impact from odor.

Fauna and flora

1) Aquatic fauna and flora

22. The biological groups of aquatic fauna and flora are as follows;

a) Bacteria
b) Phytoplankton
c) Zooplankton
d) Seaweeds
e) Attached organisms
f) Coral
g) Benthic organisms
h) Fish and shellfish for fisheries

23. Dredging and soil dumping cause reduction of areas inhabited by aquatic life. Furthermore aquatic life is threatened by the increase of suspended solid.

24. In this case, the scale of dredging and reclamation is limited and the area of dredging and reclamation is inside of port area. Furthermore, there are no fishing grounds and marine preservation areas near the construction site. Substitute areas for aquatic life exist. (refer to Appendix 9-3,4)

25. Also, it is thought that impact to water quality during the construction period will be permissibly small. Therefore, it seems that impact to aquatic fauna and flora will be small.

2) Terrestrial fauna and flora

26. The biological groups of terrestrial fauna and flora are as follows;

a) Vegetation
b) Mammals
c) Birds
d) Reptiles
e) Amphibian
f) Insects
g) Others/Terrestrial shells, spiders

27. Operation of construction machinery hinders lives of terrestrial fauna and flora. Thus air pollution, noise and vibration make their living conditions worse.

28. In this case, the construction site is inside of the port area. So almost no terrestrial fauna and flora live in above area. Also, it is thought that impact to air quality and impact of noise and vibration during the construction period will be small. Therefore, it seems that impact to terrestrial fauna and flora will be small. (refer to Appendix 9-5)

Wastes

29. With construction works, part of construction materials and surplus soil are generated. In general, the volume of wastes depends on the scale of construction works. So the construction plan and method are very important to decrease the volume of wastes.

30. In this case, the scale of construction works is not so large and construction plan and method will consider the environmental conditions around Bitung municipality. Therefore, it seems that the impact of wastes will be small during the construction period.

Socio-culture

31. In general, construction works require many laborers. If there is a shortage of local laborers, some laborers will come from other areas. With this situation, it is thought that some problems regarding race, religion, customs, culture may arise between foreign laborers and local people.

32. In this case, the scale of construction works is not so large and the hinterlands of the construction site are Bitung municipality and Manado municipality. Therefore, it seems that most of the required laborers will be secured from the above area, so above problems will not occur.

Socio-economy

33. In general, with employment of laborers for construction works, it is expected that new economic activities will emerge and will contribute to the activation of the hinterlands. On the other hand, with passing of construction vehicles and vessels, land traffic and sea traffic will be disturbed. Furthermore, decrease of tourism resources and fishery resources will occur by muddy water. Fishery activities will also be restricted.

34. In this case, the scale of construction works is not so large. But it is expected that the economic activities regarding the construction works will contribute to the activation of the hinterlands. On the other hand, there are no fishing grounds or tourism spots near the construction site, so it seems that there is no impact to fishery activities and tourism resources. Furthermore, considering the construction plan and method, it seems that traffic problems will not occur. (refer to Appendix 9-3,4)

C. Impact Assessment of Existence of Port

Presupposition of estimates

35. Based on the port development plan at Bitung port which is described in Chapter 6, the impact assessment of existence of port was carried out. The present socio-economic, natural and environmental conditions are based on Chapter 2 and 3.

36. There are little existing environmental monitoring data, in spite of the fact that the Indonesian government does have some regulations regarding the environment. Therefore, in this study, the target of environmental preservation was established as follows;

" The impact to environment will be permissibly small. "

Water quality

37. In general, sea water is stagnant when surrounded by break water or reclamation area. If nutrients are added in above water area, photosynthesis by planktons increase and organic substances which are indicated by COD increase. The organic substances produced by photosynthesis die and are piled up on the bottom of the sea; after that, they are decomposed into inorganic substances. Furthermore, during above process, dissolved oxygen (DO) is consumed, then oxygen depleted water appears at the bottom stratum. Above phenomenon is called eutrophication. This phenomenon cause offensive odor and impact to aquatic lives.

38. At the planning stage, it is very important that a closed sea area is not created. In this case, the sea area surrounded by Interisland wharf, the cement berth and the new container berth represents a closed sea area, but the width of waterway is wide, so it is possible to have good circulation of sea water. Therefore, it seems that the impact to water quality will be small.

Topography

39. Dredging for waterways and basins and reclamation are actions which change topography. Beach erosion and accretion due to pattern change of littoral drift affect existing forms of use of land and water area. Extinction of tidal flats effect changes in underground water level (pressure). Sea water intrusion, which affect forms of water use in surrounding area and terrestrial vegetation including mangroves.

40. In this case, the dredging for waterways and basins and reclamation will be carried out, but above areas are inside of the port area. At present the areas around the new development area are mostly covered with man-made construction. On the other hand, there are no tidal flats near the construction site. The new reclamation area is limited. Therefore, it is seems that above impacts will be small.

Coastal hydrology

41. In general, it is thought that tidal current is affected by existence of reclamation areas and breakwaters. If the impact to the tidal current is large, various impacts to the environment around the port will occur. Therefore, it must be considered that the impact of tidal current will be permissibly small at the port planning stage.

42. In this case, the new reclamation area for the container terminal is planned, so, it seems that the impact to tidal current will occur. In this study, computer simulation technique was applied to investigate possible magnitude of environmental impact regarding tidal current by the proposed port development plan.

1) Outline of simulation

43. The simulation was carried out inside the area which is shown in Figure 9-2,3. In this study, the calculation cases were as follows;

(a) Case (Present) : Present situation in 1992
(b) Case (Future) : The reclamation will be completed, but operation will not begin.
(c) Case (Difference): Difference between " Future " and " Present (1992) "

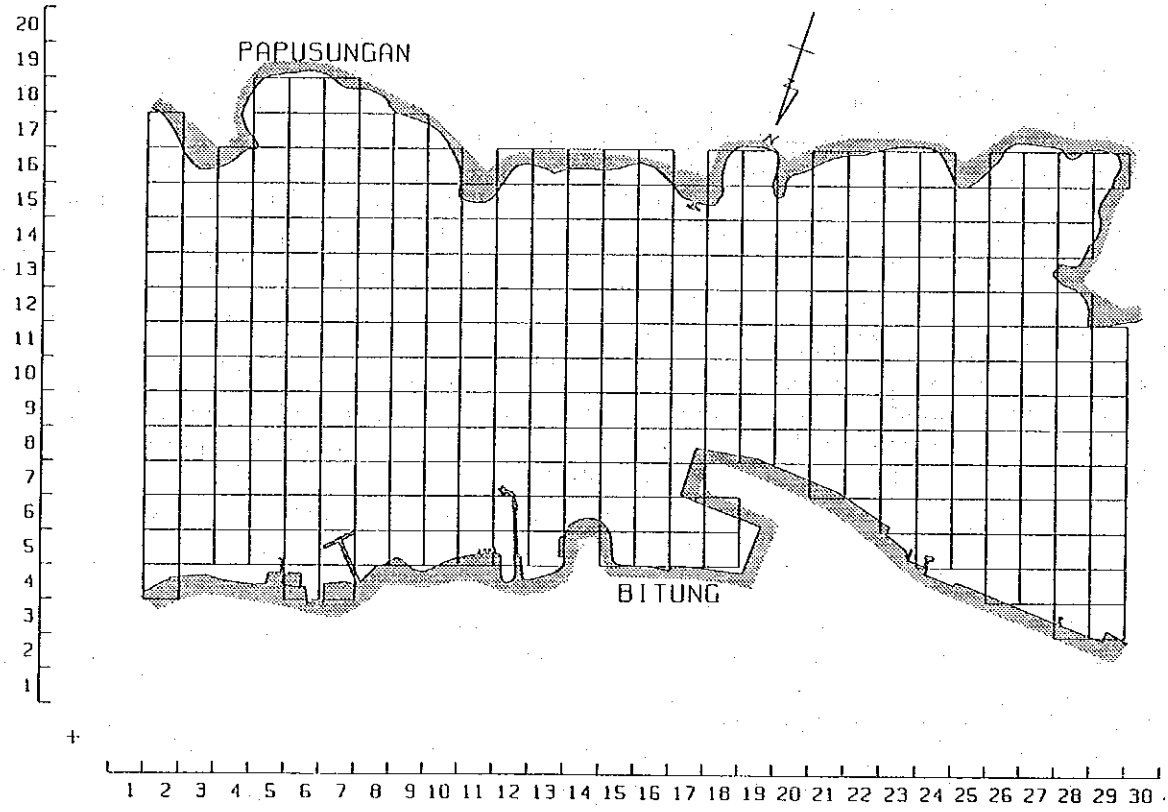


Figure 9-2 Range of Simulation [Case (Present)]

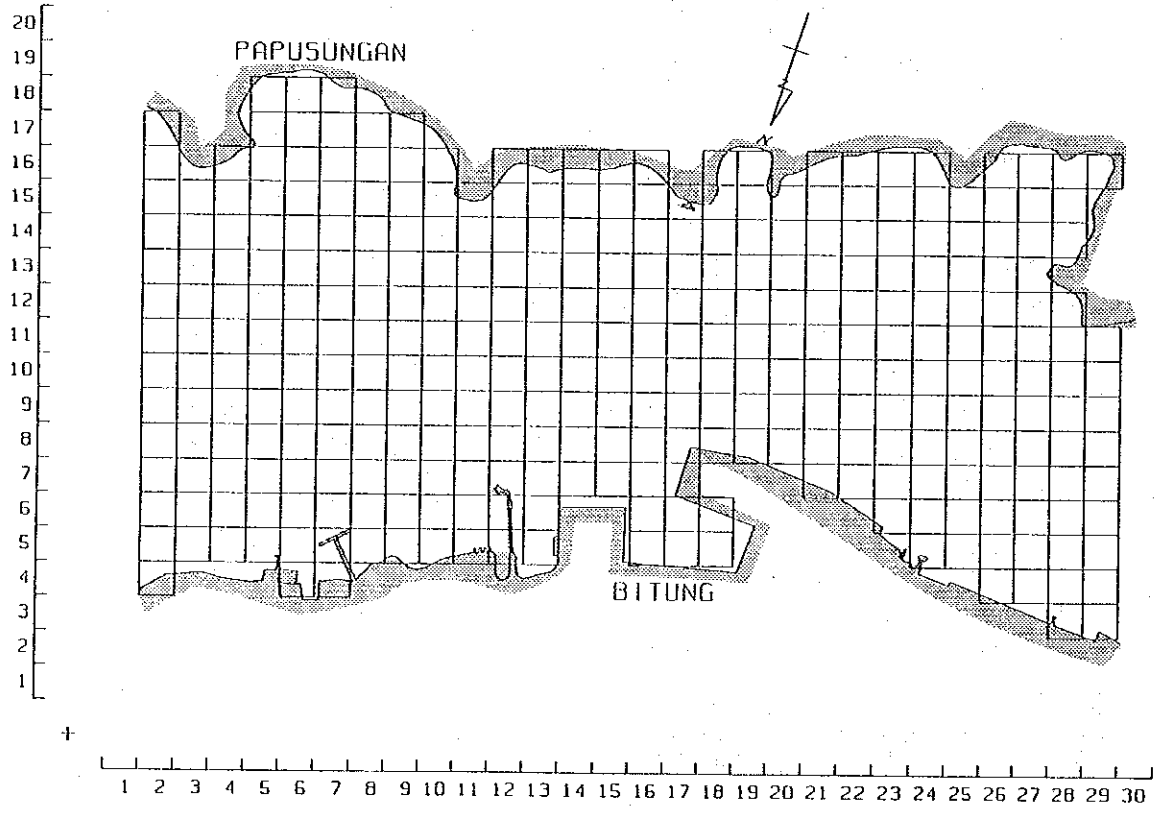


Figure 9-3 Range of Simulation [Case (Future)]

2) Methodology for simulation

44. The flow-chart of tidal current simulation is shown in Figure 9-4.

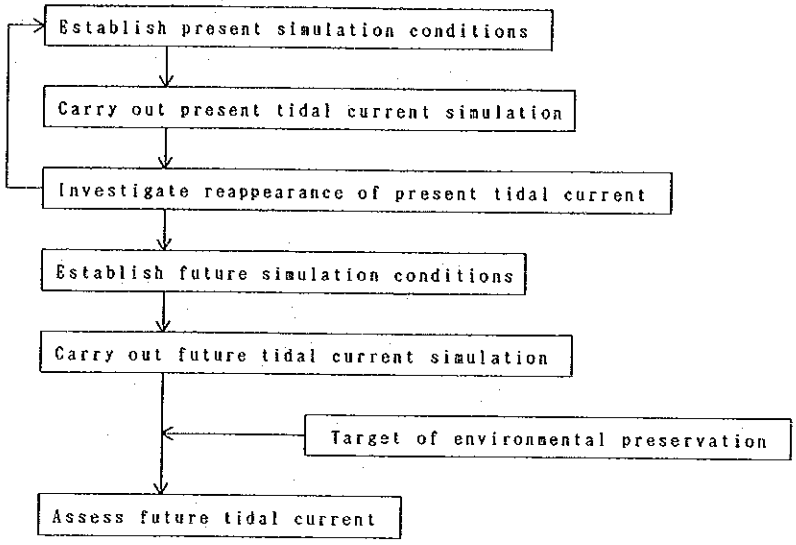


Figure 9-4 Flow-Chart of Tidal Current Simulation

45. In this study, " A depth averaged two dimensional hydrodynamic model " was applied. This model is used widely for tidal current simulation. The simulation model is shown in Appendix 9-6.

46. The simulation conditions are as follows;

(a) Range of simulation: see Figure 9-2,3
(b) Grid space : 100 m
(c) Time steps : 15 seconds
(d) Integrated time : 48 hours
(e) Horizontal eddy viscosity coefficient: 5×10^5 cm^2/sec
(f) Bottom friction coefficient: 2.6×10^{-2}

3) Results of simulation

47. The result of the reappearance of present tidal current is shown in Appendix 9-7. According to this result, the result of the simulation coincided with the monitoring data permissibly.

48. The results of the simulation are shown in Figure 9-5 and Appendix 9-8,9.

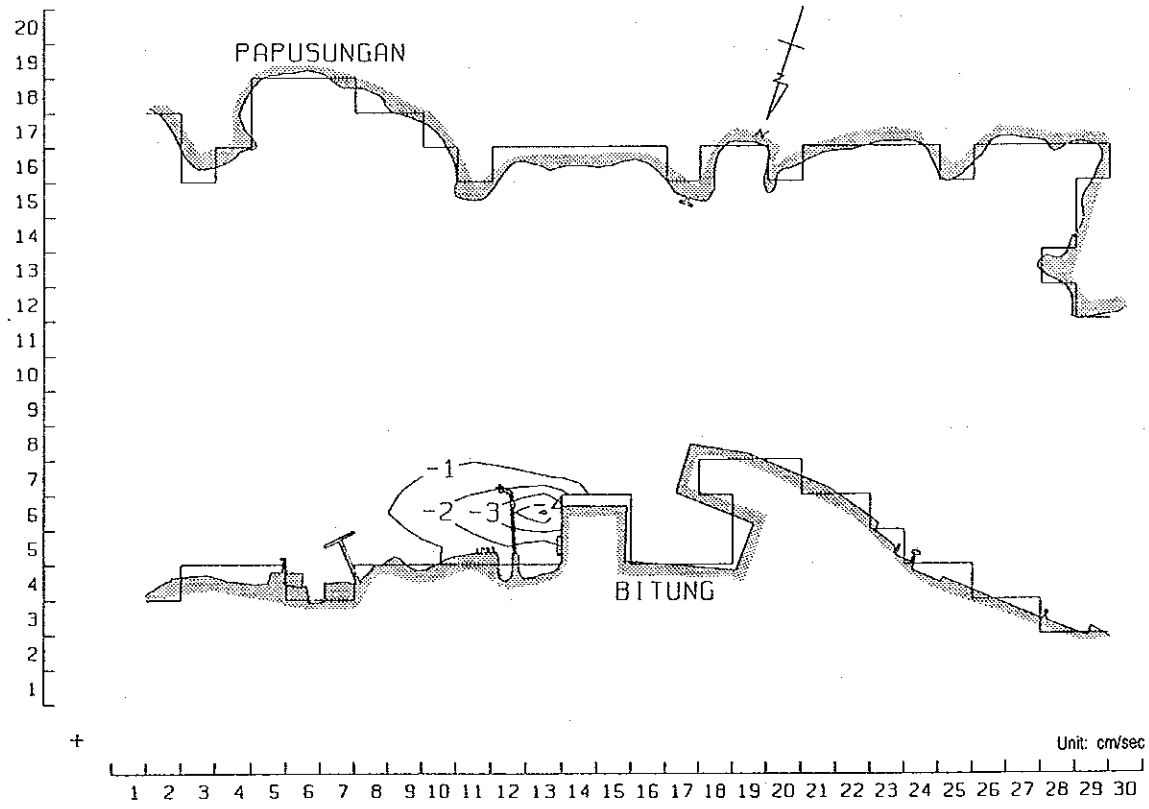


Figure 9-5 Tidal Current Velocity Difference [Case (Future-Present)]

4) Assessment

49. According to above results, transition area of tidal current will be limited and transition of tidal current velocity will be small. Thus, the utilization of water area around this port will not be impacted. Therefore, it seems that the impact to tidal current will be permissibly small.

Fauna and Flora

1) Aquatic fauna and flora

50. Reduction of habitats of benthic organisms (including corals), plankton, weeds, fish and shells is due to partial extinction of water area. Eutrophication progresses by the changes of current and water and bottom quality. After that the inhabited environment will be changed by above phenomena indirectly.

51. In this case, the scale of the reclamation is limited, so the areas which aquatic lives inhabit will decrease only slightly. Also, the impact to water quality will be small. Therefore, it seems that the impact to aquatic fauna and flora will be small.

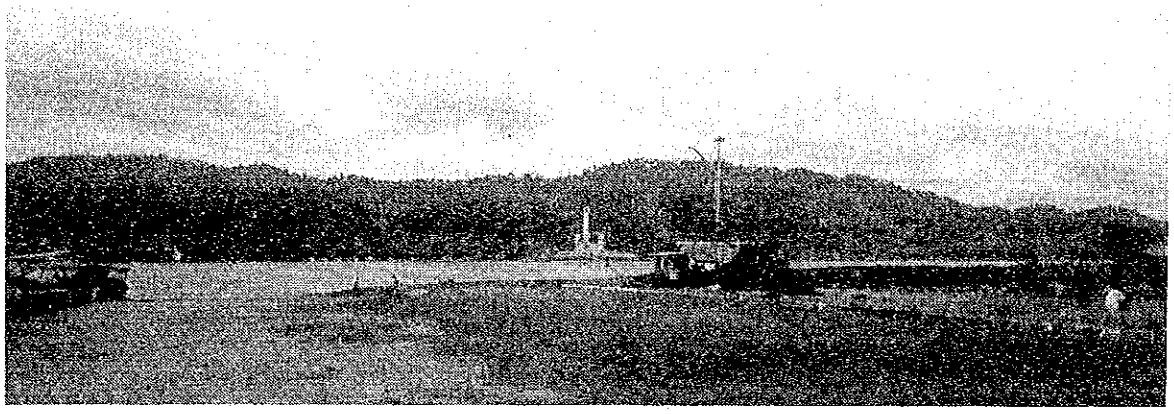
2) Terrestrial fauna and flora

52. The existence of the reclamation areas decrease inhabited areas of terrestrial lives (including mangrove). In this case, the new reclamation area is inside of the port area, so almost no terrestrial fauna and flora are found in this area. Mangrove is also not found in this area. Therefore, it seems that the impact to terrestrial fauna and flora will be very small. (refer to Appendix 9-5)

Scenic view

53. Scenic view would be altered by existence of reclamation areas. Large scale of reclamation areas and long breakwaters will form man-made landscape. National parks and the areas which should be considered as the landscape must be protected by the regulations.

54. In this case, the new reclamation area is inside of the port area. (see Photo 9-1) Therefore, it is thought that the new reclamation area is similar to existing area, so it seems that there will be no impact to scenic view.



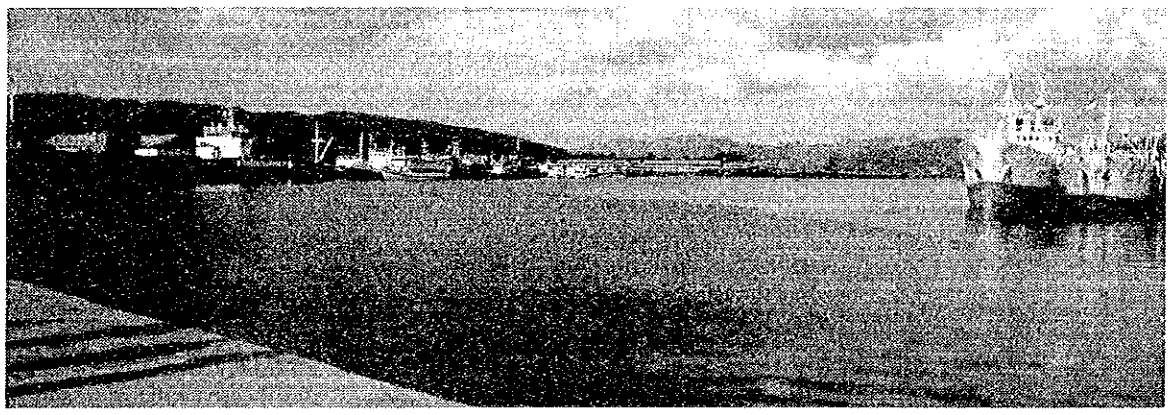


Photo 9-1 Present Situation of Project Site at Bitung Port

Socio-culture

55. When land is reclaimed, there is a probability that inhabitants, cultural assets, historic spots, etc. around above areas will have to move. This can be a big problem for local people who have depended on this area for their livelihood.

56. In this case, the new reclamation area is inside of the port area and there are no inhabitants, cultural assets and historic spots near this area. Therefore, it seems that there will be no impact to socio-culture.

Socio-economy

57. When land is reclaimed and breakwaters are constructed, there is a probability that fishery and cultivation activities will be restricted. Furthermore, their existence is an obstacle to hydro facilities and water drainage.

58. In this case, the new reclamation area is inside of port area and there are no fishing and cultivation fields near this area. There are no hydro facilities and drainage areas near this area. Therefore, it seems that there will be no impact to socio-economy.

D. Impact Assessment of Utilization of Port Facilities

Presupposition of estimates

59. Based on the port development plan and the port management and operation at Bitung port which are described in Chapter 6 and 10, the impact assessment of utilization of port facilities was carried out. The present socio-economic, natural and environmental conditions are based on Chapter 2 and 3.

60. There are little existing environmental monitoring data, in spite of the fact that Indonesian government does have some regulations regarding the environment. Therefore, in this study, the target of environmental preservation was established as follows;

" The impact to environment will be permissibly small. "

Air quality

61. In general, the major pollutants generated by ports are dust gases. The primary sources of dust are road traffic and dry bulk cargo operations. Gas emissions are produced by ships, cargo handling equipment and waterfront industries. Smoke, soot, fumes and vapors are also generated by ships, cargo storage and handling and waterfront industries.

62. The typical air pollutants are Sulphur oxides (SOx), Carbon monoxide (CO), Suspended particulate matter (SPM), Nitrogen oxides (NOx) and Dust. The air quality indicators are SO_2, CO, SPM, NO_2. (refer to Appendix 9-10)

1) Impact of ships

63. Ships generate SOx, NOx, Dust and CO. The volume of these air pollutants is proportional to the volume of fuel consumption. The volume of fuel consumption when ships are berthing has a large share of total volume. Therefore, the major impact to air quality around this port depends on "Ship call" and " Berthing time". The discharge volume of these air pollutants depends on the quality of fuel.

64. In this case, the ship calls at this port will increase until the year of 2000. On the other hand, it seems that the berthing time at this port will decrease with the advance of containerization. Furthermore, by imposing legal control on air quality, ships will have to use good quality fuel which contain little sulphur in 2000. Therefore, it seems that the impact of air pollution caused by ships will be permissibly small.

2) Impact of road traffic

65. As port throughput increases, so too will the road traffic. There is a probability that air pollution caused by SOx, NOx, CO, SPM and dust will be generated with the increasing road traffic.

66. In this case, it seems that road traffic will increase until the year of 2000. But the new waterfront road is planned in 2000, so this road will be useful for adequate road traffic control. Also, by imposing legal control on air quality, vehicles will have to use good quality fuel which contain little sulphur and will have to be equipped with high quality engines. Therefore, it seems that the impact of air pollution caused by road traffic will be permissibly small.

3) Impact of port activities

67. When bulk cargoes are handled, dust is generated. Dust adversely affects human health. On the other hand, if dust falls into the sea area, water quality and bottom sediment quality will become worse.

68. In this case, a cement packing plant is planned, so it seems that the impact of air pollution caused by bulk cargo handling will occur. But if this plant uses cargo handling equipment which have contrivances preventing diffusion of dust and if a buffer zone is established around this plant, it seems that above impact will be able to be permissibly small.

Water quality and bottom conditions

1) Water quality

69. In general, it is thought that water quality is affected by port activities. Chemical oxygen demand (COD) is a major indicator regarding sea water pollution. Therefore, scale of water pollution caused by port activities is mainly indicated by transition of COD concentration.

70. In this study, computer simulation technique was applied to investigate possible magnitude of environmental impact regarding water quality.

(a) Outline of simulation

71. The simulation was carried out inside the area which is shown in Figure 9-2,3. In this case, the calculation cases were as follows;

Case (Present) : Present situation in 1992
Case (Future) : Future situation in 2000
Case (Difference) : Difference between Present Case and Future Case

72. In this study, it is assumed that the future situation in 2000 excluding the port area is fixed at the present situation in 1992 because the purpose of this simulation is just to estimate the impact of utilization of port facilities.

(b) Methodology for simulation

73. The flow-chart of water quality simulation is shown in Figure 9-6.

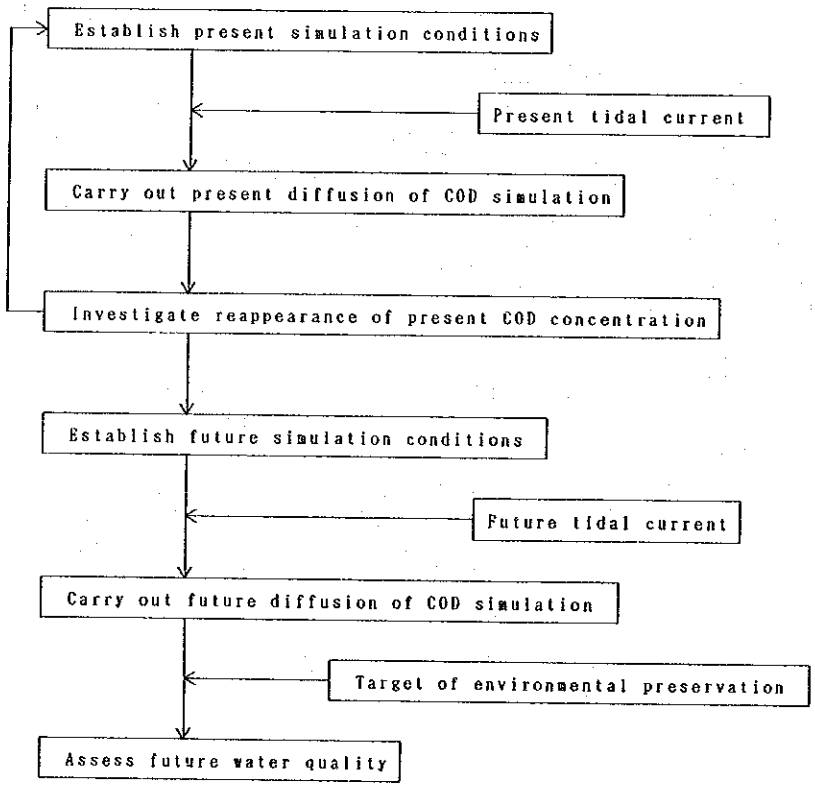


Figure 9-6 Flow-Chart of Water Quality Simulation

74. In this study, " A depth averaged two dimensional diffusion model for passive materials " was applied. This model is used widely for water quality simulation. The simulation model is shown in Appendix 9-11.

75. The simulation conditions are as follows;

* Range of simulation : see Figure 9-2,3
* Grid space : 100 m
* Time steps : 150 seconds
* Integrated time : 60 ebb and flow (720 hours)
* Initial concentration of COD: 25.0 mg/l
* Horizontal eddy diffusivity: 1.0×10^4 cm^2/sec
* Load of COD: Volume of drainage x Unit of COD (Kg/day) [Port area]
  Area x Unit of COD per area (Kg/day) [Other area]

(c) Results of simulation

76. The result of reappearance of present water quality is shown in Appendix 9-12. According to this result, the result of the simulation coincided with the monitoring data permissibly.

77. The results of the simulation are shown in Figure 9-7 and Appendix 9-13,14.

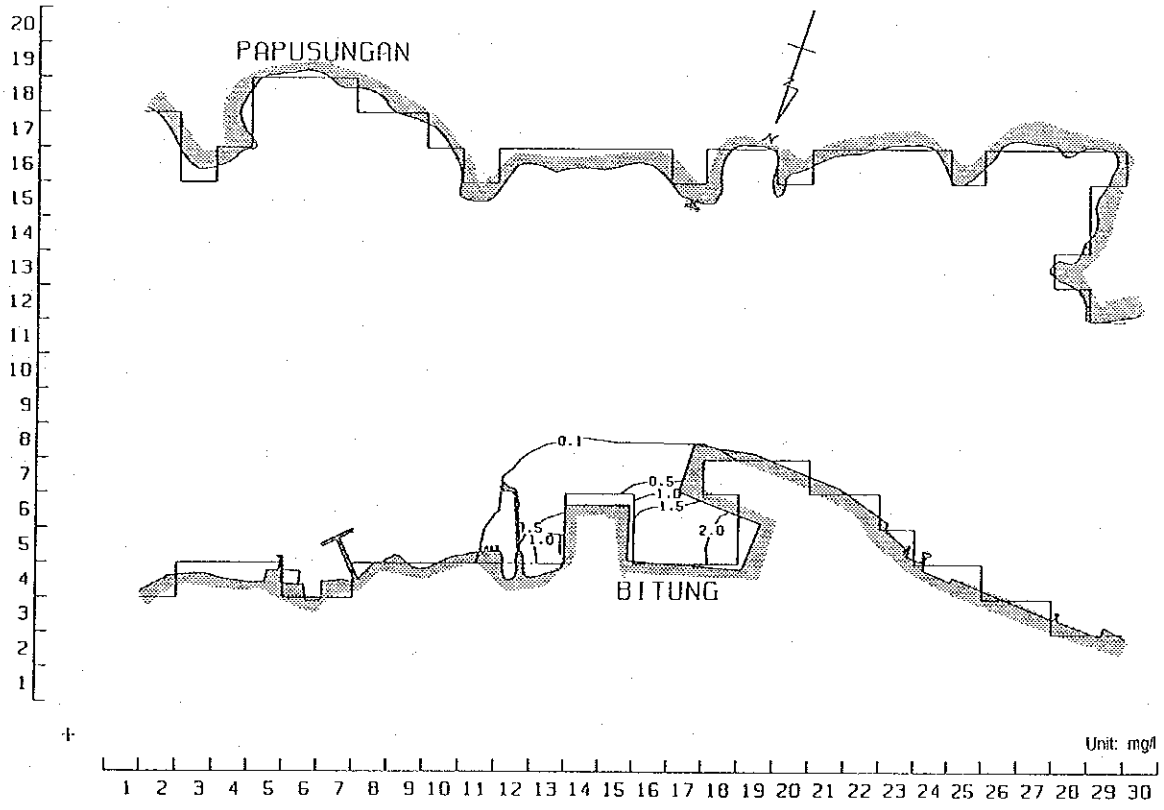


Figure 9-7 COD Concentration Difference [Case (Future-Present)]

(d) Assessment

78. According to above results, transition area of water quality will be limited and transition of concentration of COD will be maximum 2 mg/l. So it is thought that about 7 % of present concentration will increase. However maximum concentration of COD is lower than the environmental preservation criteria, even if it is applied to "Coastal water quality grade Bathing (40 mg/l)". By the way, it seems that this impact is not only from the utilization of port facilities but also a appearance of closed sea area. Therefore, if the area which runs in the load of COD generated by city life will be able to be changed from the existing port area to another area, it is thought that the concentration of COD at above area can be decreased. So it seems that the impact to the water quality will be permissibly small. (refer to Appendix 9-15)

2) Bottom conditions

79. Generally speaking, bottom conditions are related to water quality. In this case, according to the results of above simulation, the impact to the water quality caused by port activities will be small. Therefore, it seems that the impact to the bottom conditions will be small.

Noise and vibration

80. Noise and vibration are public nuisances associated with road traffic, and operation of port facilities. The primary sources of noise and vibration are operation of vehicles and cargo handling equipment.

1) Impact of road traffic

81. As port throughput increases, so too does road traffic. Noise and vibration depend on the road traffic volume. Traffic jams also contribute to noise and vibration.

82. In this case, it seems that road traffic will increase until the year of 2000. But the new waterfront road is planned in 2000, so this road will be useful for adequate road traffic control. Thus it is thought that traffic congestion will increase only slightly. On the other hand, with imposing legal control on noise and vibration, vehicles will have to be equipped with low noise engines. Therefore, it seems that the impact of noise caused by road traffic will be permissibly small. It follows that the impact of vibration caused by road traffic will be permissibly small. Because vibration is related to noise.

2) Impact of port facilities

83. Noise and vibration caused by cargo handling equipment have an impact during port operation time. In general, it is said that the power level of major cargo handling equipment like crane, forklift, etc. is about 100 dB(A). The noise level declines in proportion to the distance from the source. Based on a logarithmic scale, a decline of half the sound energy is measured as a decline of 3 dB(A) on the scale. In case of a point source of noise, the noise level in dB(A) declines by 6 dB(A) at every double distance from the source.

84. In this case, the distance between the new port area (New container terminal) and residential areas is more than two hundred meters. According to an example of noise reduction at certain distances, if the generated noise level is 100 dB(A), the noise level at a distance of 20 m is 66 dB(A) in case of point noise source. (refer to Appendix 9-2) Furthermore, trees, fences, houses and similar obstacles are effective barriers against noise. Thus, it seems that the impact of noise caused by cargo handling equipment around Bitung port will be small. Likewise, it seems that the impact of vibration also will be small.

Odor

85. In general, the substances causing stench are ammonia, trimethyl amine, etc.. The primary sources of them are farm and fishery products which are handled at the cargo sorting facilities and the storage facilities.

86. In this case, above commodities mainly will be handled at the existing facilities. The distance between them and residential areas is more than 400 m. Therefore, it seems that there will be little impact from odor.

Topography

87. Ship wave is caused by operating vessels. There is a probability that natural seashore is eroded by ship wave.

88. In this case, according to the regional development plan, the areas around this port will be almost fully developed. Therefore, it is thought that there will be little natural seashore around this port. So it seems that the impact to topography will be very small.

Fauna and Flora

1) Aquatic fauna and flora

89. It is thought that draining from cargo sorting facilities and the storage facilities causes a change in water quality and bottom sediment quality. In this case, the impact to water quality caused by port operation will be small. Therefore, it seems that the impact to aquatic fauna and flora will be small.

2) Terrestrial fauna and flora

90. It is thought that air pollution, noise and vibration caused by port activities and road traffic affect the physiology of terrestrial fauna and flora. In this case, the impact of air pollution, noise and vibration will be small. Therefore, it seems that the impact to terrestrial fauna and flora will be small.

Wastes

91. In general, with port activities, wastes are generated. For example, waste oil is generated by vessels, furthermore, bulky garbage, ashes, mud and other excretions are generated by cargo handling, etc..

92. In this case, it is thought that above wastes will be generated. But if the adequate disposal plans are formed, it seems that the impact of wastes will be permissibly small.

Socio-culture

93. It is thought that preparation of traffic network will cause changes in the local population distribution and changes in the forms of communication. In this case, Bitung port is already playing an important role in shaping socio-culture conditions. Therefore, it seems that the impact to socio-culture will be small, even if port throughput at this port will increase until the year of 2000.

Socio-economy

94. If fishing grounds exist near a port, there is a probability that fishery activities will be restricted. On the other hand, the operation of a port, means that additional employment will be required and economic activities will be improved.

95. In this case, there are no fishing grounds near the port, so it seems that there is little probability that fishery activities will be restricted. On the other hand, it seems that there is a high probability that additional employment will be generated and economic activities will be improved, because the cargo handling volume at this port will increase rapidly until the year of 2000.

E. Countermeasures for Environmental Preservation

General

96. According to the results of environmental impact assessment regarding the port development at Bitung port, the countermeasures for environmental preservation are required to maintain the target of environmental preservation. Therefore, following countermeasures will have to be considered when this project begins.

Port construction stage

97. Following countermeasures are effective for maintaining the water quality during the construction period.

(a) When dredging is carried out, silt protector should be set up around the dredging area.
(b) After the shore protection is completed, the reclamation works should be started.

Port utilization stage

98. Following countermeasures are effective for maintaining the water quality.

(a) The sewage generated by port activities must be treated adequately.
(b) The bilge water generated by vessels must be treated adequately.
(c) The drainage generated by the civic life should not flow into the closed port sea area.

99. Following countermeasure is effective for maintaining the air quality.

(a) When bulk cargoes are handled, any cargo handling in system which diffusion of dust can be prevented should be adopted possible.

F. Monitoring of Environment

General

100. The port development plan at Bitung port considered the environment. But it is necessary to monitor the environment around the project site. In particular, the monitoring of water quality during the construction period is very important.

Monitoring plan

101. The major indicator of water pollution caused by construction works is Suspended Solid (SS). The primary source of SS are dredging and reclamation works. Transparency and Turbidity are sometime used as the auxiliary indicators of water pollution caused by construction works. In general, it takes long time to analyze SS and Transparency and Turbidity are analyzed immediately.

102. In this case, the monitoring of water quality should be carried out during dredging and reclamation works period. The monitoring items are SS, Transparency and Turbidity. The monitoring points are more than two points and the monitoring depth is upper layer (0.5 m from surface) and middle layer (half of the water depth). The draft monitoring points are shown in Appendix 9-16. The frequency of monitoring is once a week during dredging but during reclamation works, the frequency of monitoring is once a month. The target of environmental preservation should be established based on the present water quality and water utilization around the construction site.

G. Conclusions

103. According to the results of the EIA, it seems that the impact to the environment around Bitung port which will be caused by this project will be permissibly small in case of the conditions assumed in this study.

104. The EIA which was carried out in this study is a preliminary EIA of a feasibility study. Therefore, full-scale EIA based on Indonesian government regulations will have to be carried out after the detail design are decided.

105. In order to carry out the full-scale EIA, following major environmental constituent factors should be monitored.

(a) Air quality : NO_2, SO_2, CO, SPM, Dust
(b) Water quality : pH, DO, COD, BOD, Oil, Coliform bacteria
(c) Bottom sediment : COD, Ignition loss, Sulfide, Hazardous objects
(d) Noise and Vibration
(e) Aquatic fauna and flora, Terrestrial fauna and flora

Chapter 10 PORT MANAGEMENT AND OPERATION

A. Introduction

1. To promote port use, it is essential to provide attractive port services to port users, especially berthing vessels and handling cargo with safety and speed. In this chapter, from the above points of view, we have examined problems in the port management and operations and made some recommendations. Also management for new container terminal in the port facility development plan has been drafted.

B. Problems and Recommendations on Port Management and Operation

Cargo handling operation

2. According to demand forecast in chapter 5, in 2000 the public cargo volume will reach two million tons, nearly 1.8 times that in 1992. Also containerization will increase year by year and the ratio of containerization will reach 35% in 2000. To cope with the increasing cargo volume, not only is the introduction of three shift system cargo operation required, but increase of efficiency of the cargo handling operation is also vital for improving the services at Bitung port, as mentioned in Section C of Chapter 6. In this section, from the above points of view, problems in the present system will be described and recommendations for improving efficiency of the cargo handling operation will be made.

1) Introduction of flexibility in gang formation for cargo handling

3. The current gang size for cargo handling consists of a total of 48 persons; 12 persons for stevedoring, 24 persons for cargodoring and 12 persons for delivery. This gang formation is fixed regardless of the kinds of commodity and packing type of cargo. However there are some cases in which it would be more appropriate to set the gang size and formation so as to better respond to the particular characteristics of the cargo involved and the handling system. For example of some ports in an advanced country, one gang for stevedoring is organized with 10-12 persons in the case of bagged cargo such as wheat and soybean and 9 persons in the case of pulp or lumber. To introduce flexibility in gang formation, it is necessary that handling companies should have close contact with KOPERASI TKBM while ADPEL should take the initiative and control them strongly, so that port laborers will not lose their employment opportunities.

4. The improvement of stevedoring productivity by flexible gang formation will reduce mooring time of vessel which in turn will require more speedy cargodoring and delivery. This can be realized by introducing more equipment and unitization such as forklift and pallet system.

2) Cargo handling equipment

5. In the port of Bitung there are only two mobile cranes for stevedoring with capacity of 25 and 15 tons and they are repeatedly damaged. Therefore when they handle containers which exceed their capacity, they are obliged to van or devan

containers on vessels inefficiently. Also PERSERO Bitung port office does not have head truck or top loader to transport containers so it must rely on other company to marshal them in the open storage yard. To cope with future trend of containerization, container handling equipment such as head trucks, top loader and mobile crane with adequate capacity should be furnished in this port.

6. As for cargodoring equipment, there are 12 units of forklifts with capacity of 2-5 tons, of which six units belong to PERSERO, and the remaining six units belong to a private cargo handling company. To cope with the increase of cargo volume and realize efficient operation, it will be required to introduce still more mechanization and rationalization to cargo handling. Especially in the port of Bitung, there are many transit cargoes, while the wharf area and storage area are separated from each other. Thus, there is a large amount of transversal transportation of cargo in the wharf as well as between the wharf and storage areas. The direction of cargo movement is thus complicated and the distance of cargo transportation handling is considerably long. To cope with such a situation, adequate cargo transport equipment such as forklift, trailer and so on should be furnished. Since cost for port labor is considered to be increased in future, cargo handling with only man power will become uneconomical compared to efficient cargo handling with adequate equipment.

7. Also, efficient operation of the port entails mechanization with as little capital outlay by PERSERO as possible. Rather, the goal is to encourage private cargo handling companies cooperatively to provide a certain amount of the necessary machinery.

Maintaining the cargo handling equipment in good condition

8. Three mechanics of technical division are in charge of maintenance for cargo handling equipment such as forklifts and mobile cranes. However, they do not inspect them regularly but only in case of problems such as engine trouble. Also most of repair work is contracted to a private repairing company, but the procurement of spare parts is very difficult in the city of Manado or Bitung and they must be sent from Surabaya or Jakarta. Therefore once a piece of equipment breaks down, it takes a long time to get it repaired.

9. In addition, the present budget allocated for maintenance is too small to maintain the equipment in good condition, namely Rp 10 million for two mobile cranes and Rp 17 million for six forklifts.

10. Importance of mechanization and rationalization of cargo handling has been described previously. To realize rational cargo handling, this equipment must be properly maintained in good condition and must be utilized to the fullest extent. To accomplish this goal, the following points should be kept in mind.

(i) It is necessary not only to inspect handling equipment regularly but also to stock those spare parts which are used often. By doing this, troubles during cargo handling and the long period of maintenance should be avoided. If it is difficult for a branch office to stock the necessary spare parts, PERSERO head office should stock them and distribute them quickly to branch offices when need arises.

(ii) More funds should be allocated for maintenance so as to put this handling equipment in better condition. Also, once they get out of order, they should be fixed as soon as possible. Nothing is so uneconomical as non-working equipment under any budgetary circumstance. For example the

average yearly operation of forklift is only 153 days/year in 1992. These low activities are due to very limited supply of forklifts because they are repeatedly damaged. Good maintenance should be given priority to support smooth operations and efficient use of limited funds.

Training and improvement of working conditions for port labor

11. As for port labor in many developing countries, experience in cargo handling, particularly in modern techniques, is often lacking, as well as a sense of responsibility for the safety of cargo and the port laborer himself. Therefore appropriate training is essential. This applies to the situation at Bitung port.

12. In Bitung port, previously under YUKA (previous status of KOPERASI TKBM) training courses for port labor had been held once a year on operational techniques of handling equipment and safe management while operating. The period of this training course was one week and about sixty port laborers had participated in it every year. But after transferring its status into KOPERASI these kinds of training courses for port laborers have been discontinued due to financial difficulties and lack of equipment.

13. As mentioned previously, modernization of cargo handling such as introduction of mechanization and proceeding of cargo unitization is considered increasing necessary to enhance port productivity in Bitung port. To adapt port laborers to this modernization, training and education will play an important role. In particular, constant and reinforced training is indispensable for port labor to continually up-date their knowledge keeping in step with required modernization of operation system. Without adequate training for port labor, modernization of port operation will undoubtedly fail. However, the number of participants in the previous training courses seems to have been too small compared to the number of total registered port laborers. Training course should not only be resumed but also reinforced through increase of participants and frequency of training courses. Also, cargo handling companies should support reinforcement of port labor training not only financially but also by offering funds, staff, equipment and so on.

14. For a port to function smoothly, a skilled and stable port labor is necessary. For that purpose it will be important to offer good quality working conditions to port labor as well as adequate port labor training.
At present there is no adequate welfare or recreation facilities for port laborer except a small restroom in KOPERASI office in Bitung port. There should be inexpensive and clean restaurants, restrooms with clean toilets and shower rooms near the wharf. Also good trained skilled labor should be hired at adequate payment with productivity incentives. It is not too much to say that efficiency of individual workmen depends also on the care that is taken in respect of their welfare. It is desirable that these services be implemented by cooperation between KOPERASI, stevedoring companies and PERSERO under the guidance of ADPEL.

Effective utilization of open yard

15. Current open yard utilization in Bitung port seems to be in disorder, that is, containers are scattered here and there, and in one yard, containers, lumber and general cargo are stored without proper separation. It is supposed that this disorder causes an impediment for effective utilization of open yard and efficient cargo handling. As mentioned previously, this problem is derived from the fact that

PERSERO office does not have adequate equipment to marshal containers by itself. It is expected that cargo volume will increase and containerization will progress more and more. In this circumstance, to enhance efficiency of transporting, open yard should be classified according to type of cargo, such as establishment of specialized container yard.

Handling of special cargo and large quantity cargo

16. Generally, this kind of cargo is effectively and preferably handled exclusively at a special pier. Such kinds of cargo are coconut oil, cement and rice in the port of Bitung. At present, coconut oil is loaded specially at loading point and west end of Oceangoing wharf. As regards cement, the new wharf for cement bulk vessels is scheduled to be furnished in 1995. Also as for other large quantity cargo such as rice and animal feed, it is desirable to proceed toward specialization of the wharf step by step according to increase of the cargo volume in future.

New container terminal management

1) Terminal operation

17. Operation flow and necessary jobs for handling in container terminal are shown in Appendix 10-(1) for loaded containers and in Appendix 10-(2) for unloaded containers.

18. As for loaded containers, prior to a ship's arrival, loaded FCL containers (full container load cargo) are received at the gate office and stacked in the container yard, while loaded LCL cargoes (less than container load cargo) are brought into the CFS by shippers, and then stuffed into containers by the operator. All loaded containers (full and empty) are loaded onto a ship in accordance with the loading sequence plan.

19. As for unloaded containers, all of them are discharged from ships and then transferred to the container yard for stacking. FCL containers are basically delivered from the container yard directly to consignees through the gate office. Containers with consolidated cargoes (LCL containers) are moved to the designated shed (CFS, container freight station). Cargoes are unstuffed from the containers in the CFS, sorted, and then delivered. The empty containers are then stored at the container yard.

20. At present, in most ports handling containers, except large container ports such as Tg.priok or Tg.perak, where intermodal container transportation system by special head truck and chassis has not spread fully, most unloaded containers, irrespective of LCL or FCL, are stripped in open yard and containered cargoes are transshipped to ordinary trucks in many cases; reverse operation is conducted in case of loaded containers. However reduction of time and cargo damage in transshipment by intermodal transportation system is one of main merits of container transportation system. Therefore according to modernization of forwarding system, it is supposed that operation flow mentioned previously will be dominant.

2) Operating body

21. To operate the new container terminal, new sub division should be established in PERSERO branch office. An example of the organizations and number of employees required for management and operation of the terminal is recommended as shown in Table 10-1, which is derived from a study of some developed container terminals.

Table 10-1 Organizations and Number of Employees for the Operation in New Container Terminal

Sections	Function	Number of Employees	Note
General Affairs	General affairs, Personnel, Accounting	5	
Instructions Coordination	Planning of cargo handling Cargo supervisors	5	
Cargo Handling	Loading/Unloading and Transporting of cargo Daily maintenance	12	Driver of Cargo handling equipment
Cargo Storage	Cargo storage Preparing invoice	8	

Chapter 11 ECONOMIC ANALYSIS

A. Purpose and Methodology of Economic Analysis

Project

1. The project in this study is defined as development of Specialized Container Berth and Bulk Cement Berth.

Purpose

2. The basic purpose of this chapter is to investigate the economic benefits as well as economic costs which will arise from the project, and to evaluate whether the net benefits exceed those which could be derived from other investment opportunities.

Methodology

3. An Economic Internal Rate of Return (EIRR) based on a cost-benefit analysis is used to appraise the feasibility of this project (refer to Appendix 11-1).

4. In estimating costs and benefits of the projects, those should be fixed quantitatively as much as possible. Then, "Economic Pricing" is applied after the removal of "Transfer Items" such as tax. "Economic Pricing" here means the appraisal of costs and benefits in terms of international prices (refer to Appendix 11-2).

B. Prerequisites for the Economic Analysis

Benefits of the projects

5. The following benefits are considered to be brought about by the Short-term Development Plan for the study port;

(a) Savings in staying cost of vessels
(b) Contribution to the national economic development through modernization of the Port
(c) Promotion of regional economic development through development of port related industries
(d) Increased employment opportunities and incomes
(e) Improvement of cargo handling safety and reduction of cargo damage

6. Realizing these benefits is indispensable for the promotion of the study port and it will lead to the improvement of Indonesia's economic situation and international status.

7. However some of the expected benefits cannot be evaluated in strictly monetary terms, so the benefit which can be evaluated monetarily, such as (a), is considered in the cost-benefit analysis, and as for the other intangible benefits, only a qualitative analysis is undertaken.

Project life

8. Taking account of the depreciation period of the main facilities, the period of calculation ("Project Life") in the economic analysis is assumed to be 30 years after construction.

Foreign exchange rate

9. The foreign exchange rate adopted for this analysis is ;

¥ 100 = Rp. 1,975
US$1.00 = Rp. 2,083 as of June, 1993.

"With & Without" case

10. A cost-benefit analysis is conducted on the difference between the "With" case where investment is made and the "Without" case where no investment is made. In other words, incremental benefits and costs arising from the proposed investment are compared, and it is examined whether the net benefits generated by the project exceed "the Opportunity Cost of Capital" in Indonesia.

11. Therefore, considering the "Without" case is one of the key elements of the economic analysis. In arguing the merit of the "Without" case, one must consider that the true purpose is the "Regional development of Eastern Indonesia". In this Study, the following conditions are adopted as the "Without" case after various possibilities are discussed: No investment is made for the Port of Bitung.

12. The cargo volume handled at port of Bitung in target year was forecasted in Chapter 5. The cargo volume will increase after 2000 and the cargo volume by ship type in "With" and "Without" cases are assumed as follows.

Table 11-1 Distributed Cargo Volume by General Cargo, Container and Bulk Vessels

With Case

Unit : Cargo ton & Container Box

	Ocean.+Chemi-cal Wharf	Cement Berth	Container Berth	Total	
	GC+Container	Bulk Cargo	Container	Cargo ton	Container Box
2000	1,300,000	267,000	32,800	1,567,000	32,800
2001	1,300,000	267,000	40,080	1,567,000	40,080
2002	1,300,000	267,000	46,240	1,567,000	46,240
2003	1,300,000	267,000	52,800	1,567,000	52,800
2004-	1,300,000	267,000	58,080	1,567,000	58,080

Without Case

	Oceanoing+Chemical Wharf			Total	
	GC+Container	Cement Bag	Container	Cargo ton	Container Box
2000	1,300,000	267,000	32,800	1,567,000	32,800
2001	1,300,000	267,000	40,080	1,567,000	40,080
2002	1,300,000	267,000	46,240	1,567,000	46,240
2003	1,300,000	267,000	52,800	1,567,000	52,800
2004-	1,300,000	267,000	58,080	1,567,000	58,080

C. Costs

13. The cost items of the project are: construction costs, maintenance costs, replacement costs and residual values.

Construction costs

14. Construction costs are estimated in Chapter 9 of this part, and Appendix 11-3 shows construction costs of the project to be analyzed, divided into local and foreign currency portions at market prices.

Maintenance costs

15. The costs of maintaining the port facilities are estimated as a fixed proportion (1% for structures, 5% for handling equipment) of the original construction costs excluding the costs of dredging and reclamation costs. Annual maintenance costs are Rp. 1,013 million at market prices (the details are as shown in Appendix 11-4).

Replacement investment costs and residual values

16. As for handling equipment, replacement costs should be considered at the end of depreciation (Life of vessels, crane and other machine is 25, 20 and 10 years). Also, residual values should be considered as a negative cost in the final year of the project.

D. Benefits

Savings in staying costs of vessels

17. If the increased volume of cargo were to be handled only by the existing facilities, then the number of ships waiting for berth space would increase to the point where port congestion would become a serious problem.

18. Implementing the project will avert this problem, namely it will reduce the staying time of ships, that is, the time waiting for berth space and handling cargo, and this ships' cost reduction is a benefit of the project. This benefit can be calculated by multiplying the difference in ships' staying time between both cases by ships' staying costs (per unit time).

19. However, as for the common carriers such as cargo vessels, this reduction of costs may primarily benefit ship operators and all of them can not be attributed to Indonesia. Table 11-2 shows Indonesia share for the vessels calling at Indonesia. The Indonesian share for domestic trade is high, around 80 percent. However, the share for foreign trade is currently very low.

20. In this study it is assumed that 50% of the benefits attributed to foreign ship operators is assumed to return to Indonesia over time through the market

mechanism of world shipping as well as 100% of benefits for Indonesian ship operators will accrue to the Indonesian economy. According to the following Table 11-2, the total benefits to Bitung Port can be estimated at 90% of savings in costs of container and cargo vessels.

Table 11-2 Share in Cargo for Vessels

Unit : %

Indonesia 1990	Share		
	Indonesia	Foreign	Total
International Trade			
Export	14.3	85.7	100.0
Import	12.7	87.3	100.0
Domestic Trade			
Interisland ship	81.6	18.4	100.0

Source : DGSC
Excluding petroleum and its related product

Bitung Port Unit : 1,000 ton

	Year2000	Indonesia	Foreign	Total
International Trade				
Export	118	17	51	67
Import	22	3	10	12
Domestic Trade				
Interisland ship	1,979	1,615	182	1,797
Total	2,119	1,635	242	1,877

Share of Indonesia Vessels = 88.6%
= 90 %

Difference in staying time

21. The average waiting period is estimated by the results of a computer simulation in accordance with the Queuing Theory.

Ships' staying costs

22. "Staying Costs" are ship costs incurred while a vessel is within the port. The method of calculating staying costs involves determining the economic cost per day of each individual item such as labor, depreciation costs, fuel, etc., and adding these costs together.

Savings in staying cost of vessels

23. Savings in marine transportation costs are estimated from 1) and 2), as shown in Table 11-3, and the details are shown in Appendix 11-5.

Table 11-3 Saving in Ship Wating Costs

	Unit	2000	2001	2002	2003	2004-
Cargo+Cont.+Bulk	ton	15,670,000	15,670,000	15,670,000	15,670,000	15,670,000
Ship	No	693	693	693	693	693
Container	Box	32,800	40,080	46,240	52,800	58,080
Ship	No	219	268	309	352	388
Benefit	Rp'000	8,921,095	9,497,060	10,073,025	13,931,840	17,790,654

Other intangible benefits

1) Development of port related industries

24. Without the implementation of the development project, the port of Bitung will be operating at a capacity that simply maintains the existing cargo flow. Industries in the hinterland require the development of the port as a prerequisite to their smooth operations.

25. Therefore the value added by such industries is an economic benefit of this project. Also, the development of the port contributes to the improvement of the distribution mechanism and to the activation of industries in the hinterland.

2) Increase in employment opportunities

26. As for the additional employment arising from the project, employment for construction during the construction period and for operation after the facilities are completed are considered.

27. The rate of unemployment is estimated at a level of 2.8% in 1989 but disguised unemployed (persons who had a job but who worked less 35 hours a week) is 43% per employed persons , and there is excess supply of unskilled labor in the region. The construction will provide employment for those people who would remain unemployed if the project does not take place. This employment is one of the major benefits of the project. The increase in employment opportunities is estimated as 257,000 person days for skilled labor and 90,000 person days for unskilled labor.

3) Improvement of cargo handling safety and reduction of cargo damage

28. The existing yards are too narrow for safe and efficient cargo handling. Furthermore, there are no sufficient back-up facilities (warehouses, transit sheds, etc.). It is very difficult to assess the benefits of increased safety and reduction of damage in cargo handling in monetary terms. However, by construction of the new terminal and related facilities, safe cargo handling will be ensured, and the cargo damage that seems to frequently occur will be fairly reduced.

E. Economic Prices

Methodology

29. Methodology of economic pricing and applying conversion factors are as mentioned in Appendix 11-2.

Economic prices of benefit items

30. The savings in the staying cost of vessels is calculated at international prices, so this figure does not have to be converted for economic analysis. This is shown in Appendix 11-5.

Economic prices of cost items

1) Construction costs

31. In the economic analysis, these costs have to be divided into foreign currency portions, non-traded goods and labor after exclusion of tax. Labor is further divided into skilled labor and unskilled labor. The cost of skilled labor is obtained by multiplying its market price by the Conversion Factor for Consumption (CFC), and the cost of unskilled labor is calculated by multiplying its market price by a rate of the Shadow Wage Rate and the CFC. Traded goods are expressed by the C.I.F.value for imports and by the F.O.B. for exports. As for non-traded goods, the economic price is calculated by multiplying the Standard Conversion Factor (SCF).

32. Since the foreign currency portions are shown in CIF prices, they do not need to be converted into economic prices. Economic prices of nontraded goods are calculated by multiplying the SCF, and the local labor costs are converted into economic prices by using the respective conversion factors mentioned previously.

33. Appendix 11-6 shows the conversion into the economic prices of construction costs and Appendix 11-7 shows its disbursement schedule.

2) Maintenance costs

34. Since the maintenance costs include various indefinite elements, they are converted into economic prices by multiplying the SCF. Annual maintenance costs are Rp. 953 million at economic prices (refer to Appendix 11-4).

F. Evaluation

Calculation and assessment of the economic internal rate of return

35. There are various views concerning the critical percentage of EIRR used to guide a judgment as to whether a project is feasible or not. The leading view is that the project is feasible if the EIRR exceeds the Opportunity Cost of Capital (OCC). The value of OCC varies from 8% to 12% according to degree of development in each country.

36. Appendix 11-8 shows the flow of costs and benefits calculated using economic prices. The EIRR of the Project is calculated as 16%. It is generally considered that a project with an EIRR of more than around 10% is economically feasible. For this project, even though the economic calculation only takes into account the items which are easily quantified, the EIRR is fairly high. Therefore this project is considered economically feasible.

Sensitivity analysis

1) Identification of cases

37. Various uncertain factors may enter in the appraisal of the project when estimating costs and benefits. Therefore, sensitivity tests are made to see if the project is justifiable when some of these factors are varied. In this study, three

tests are made as sensitivity analysis, which are :

(a) Case when costs increase by 10 %
(b) Case when benefits decrease by 10 %
(c) Case when costs increase by 10 % and benefits decrease by 10 %

2) Result of the sensitivity analysis

38. The result of the sensitivity analysis is presented in Table 11-4. Even in the case of (c) in which EIRR is minimized, it clearly exceeds 10%. When we consider these EIRRs as well as the various intangible benefits which cannot be quantified, we conclude that the Project for the port of Bitung is unquestionably feasible from an economic viewpoint.

Table 11-4 Results of the Sensitivity Analysis

	Original Case	Case (a)	Case (b)	Case (c)
EIRR (%)	16.4	15.2	15.1	13.9

Chapter 12 FINANCIAL ANALYSIS

A. Purpose of the Financial Analysis

Purpose

1. The purpose of the financial analysis is to appraise the financial feasibility of the port facility development plan. The analysis focuses on the viability of the project itself and the influence on the soundness of the port management body during the project life.

Project

2. The project in this study is defined as development of Specialized Container Berth and Bulk Cement Berth.

B. Methodology of the Financial Analysis

Viability of the project

3. The viability of the project is analyzed using the Discount Cash Flow Method and appraised by the FIRR (financial internal rate of return). The FIRR is a discount rate that makes the costs and the revenues during the project life equal, and it is calculated using the following formula:

$$\sum_{i=1}^{n} \frac{B_i - C_i}{(1+r)^{i-1}} = 0$$

n : project life
Bi : revenues in the i-th year
Ci : costs in the i-th year
r : discount rate

4. Revenues and costs which are taken into account for the calculation of the FIRR are summarized as follows:

Revenues:	(i)	Port operating revenue
	(ii)	Subsidy (Government funds)
	(iii)	Residual value of the fixed assets at the end of the project
Costs:	(i)	Investments for the project (initial investments for the project and its re-investments)
	(ii)	Operating expense such as maintenance, repair, personnel and other costs

5. When the calculated FIRR exceeds the interest rate of the funds for the investments of the project, the project is regarded as financially feasible.

Financial soundness of the port management body

6. The influence on the financial soundness of the port management body is appraised based on projected financial statements regarding the project (Income Statements, Cash Flow Statements and Balance Sheets). The appraisal is generally made from the viewpoints of profitability, loan repayment capacity and operational efficiency, using the following ratios:

1) Profitability

7. Rate of return on Net Fixed Assets:

(Net Operating Income / Total Fixed Assets) x 100%

This indicator shows the profitability of the investments, which are presented as net total fixed assets. It is preferable to keep the rate higher than the average interest rate of the funds for the investments.

2) Loan Repayment Capacity

8. Debt Service Coverage Ratio:

(Net Operating Income + Depreciation Cost) / (Repayment of and Interest on Long-Term Loans)

This indicator shows whether the operating income can cover the repayment of principal and interest on Long-Term Loans. It must be more than 1 and it is preferable that it is over 1.75.

3) Operational Efficiency

9. Operating Ratio:

(Operating Expenditure / Operating Revenue) x 100%

Working Ratio:

((Operating Expenditure - Depreciation Cost) / Operating Revenue) x 100%

The operating ratio shows the operational efficiency of the organization as an enterprise, and the working ratio shows the efficiency of the routine operations of the port. When the calculated operating ratios are less than 70 - 75%, and the working ratios are less than 50 - 60%, the operations are considered as being efficient.

C. General Prerequisites of the Financial Analysis

Project life

10. Taking account of the conditions of the long-term loans and the service lives of the port facilities, the project life for the financial analysis is determined as the construction period and 30 years after construction.

Base year

11. For the estimation of expenditures and revenues analyzed quantitatively here, constant prices at 1993 are predominantly used. Neither price inflation nor increases in nominal wages are considered during the project life.

Cargo handling volume and number of vessels

12. The cargo handling volume and number of vessels at the projected wharf in 2000 is estimated based on the demand forecast in in Chapter 5 as shown in Appendix 12-1.

Port charge and revenue

13. The revenues from the port activities are calculated based on the present tariff system and on the cargo handling volume and number of vessels. The revenue per year during the project life is shown in Appendix 12-1.

Expenditure

1) Cost for initial investments

14. The initial investments of the project are estimated in Chapter 8. These are summarized in Appendix 12-2.

2) Reinvestment

15. The facilities and equipments will be renewed based on their services lives. The funds for reinvestment will be financed by internal resources of PERSERO III.

3) Operating expense

16. The annual operating expense for the project is assumed as follows:

(i) Personnel
The annual personnel expense is estimated based on the required number of workers and existing pay scales as shown in Appendix 12-3.

(ii) Maintenance and repair
The annual maintenance and repair costs for the port facilities are calculated as follows:
infrastructure, warehouse: 1% of the original construction cost cargo handling equipment and vessel: 5% of the original construction cost

(iii) Other expense
To provide other expense such as cost for fuel and general administration, 130 % of the annual personnel costs is included to the operating expense based on the actual situation of financial statement.

(iv) Depreciation costs
The annual depreciation costs of the port facilities and equipment are calculated by the straight line method based on their service lives as shown in

Appendix 12-2. Residual values after all depreciations are estimated as zero. Also, for the calculation of FIRR, the residual values of fixed assets at the end of the project life are assumed to be revenues of the project.

4) Tax and contribution to the government

17. Income tax ratio is assumed as 35%. Contribution to the Government is assumed as 55% of income after tax.

Fund raising

18. We assume that the funds necessary for the implementation of the project will be raised as follows:

1) Foreign funds

19. Eighty-five percent of the construction costs will be raised by soft foreign loans in this financial analysis. A soft loan for this project is assumed to be as follows:

Loan period:	30 years, including a grace period of 10 years
Interest rate:	2.6% per annum
Repayment:	fixed amount repayment of principal

Also it is appraised whether foreign loans should be the responsibility of the government or PERSERO IV in the following evaluation.

2) Domestic funds

20. Fifteen percent of the construction costs for the project is assumed to be raised by domestic funds. It is appraised whether domestic funds should be financed by the government or PERSERO IV in the following evaluation

3) Cash shortage and interest rate for deposit

21. Any cash excess will be deposited to a bank with an annual deposit interest rate of 15%. Also cash shortage will be covered by internal funds of PERSERO, because as mentioned in Chapter 2, G, liquidity of PERSERO IV is at a very high level. In this case opportunity cost for deposit will be estimated as cost for the project.

D. Appraisal of the Projects

Analyzed pattern for FIRR appraisal

22. To determine the suitable method of fund obligation and clarify the viability of the project, the following cases are studied to compare FIRR under the different prerequisites.

23. Case A

Total construction costs will be the responsibility of PERSERO IV. In this case repayment and interest from foreign loans is obligation of PERSERO IV. Also PERSERO IV must burden domestic funds of construction costs.

(Foreign Funds): Foreign loan --(GOI)--> PERSERO IV
(Domestic Funds): PERSERO IV internal funds

24. Case B

Only the portion of foreign funds (85% of total construction cost) will be the responsibility of PERSERO IV. In this case repayment and interest from foreign loans is borne by PERSERO IV. However, the portion of domestic funds is financed by the government (DIP), and PERSERO IV can acquire this portion of port facility as contribution in kind to capital.

(Foreign Funds): Foreign loan --(GOI)--> PERSERO IV
(Domestic Funds): the government (DIP budget)

25. Case C

PERSERO IV will be responsible only for the portion of domestic funds (15% of total construction cost). The portion of foreign funds is financed by the government (DIP), and PERSERO IV can acquire this portion of port facility as contribution in kind to capital. In this case the repayment and interest from foreign loans is the obligation of the government.

(Foreign Funds): Foreign loan -----> GOI
(Domestic Funds): PERSERO IV internal funds

26. Case D

Total construction costs will be borne by the government (DIP). In this case the repayment and interest from foreign loans is obligation of the government, and PERSERO can acquire port facility as contribution in kind to capital with free.

(Foreign Funds): Foreign loan -----> GOI
(Domestic Funds): the government (DIP budget)

27. To evaluate the project, the FIRR of each case is calculated and analyzed.

Sensitivity analysis

28. Sensitivity analysis is conducted to examine the impact of unexpected future changes. The following three cases are envisioned:

Case (1): The revenue decreases by 10%
Case (2): The project cost increases by 10%
Case (3): The revenue decreases by 10% and the project cost increases by 10%

Results of the FIRR calculation

29. The results are shown in Table 12-1 and the FIRR calculation and its details is shown in Appendix 12-3.

Appraisal

30. Weighted average interest rate of the funds, which is the floor limit, is 2.21% in this study. If the FIRR exceeds this rate, we can judge the case to be financially feasible.

31. Regarding Case A and Case B, in which foreign loan funds are the responsibility of PERSERO, result of sensitivity analysis falls below the feasible level.

32. On the other hand, regarding Case C and Case D, FIRR exceeds the average interest rate. Therefore as a result of sensitivity analysis, Case C and Case D are considered to be financially feasible.

Table 12-1 Result of calculation of FIRR (Port of Bitung)

Case A (Foreign Funds: PERSERO, Domestic Funds: PERSERO)

	FIRR	Remarks
Original	0.7%	
Sensitivity Analysis(1)	-0.4%	Revenue 10%Down
Sensitivity Analysis(2)	-0.3%	Cost 10%Up
Sensitivity Analysis(3)	-1.5%	Revenue 10%Down, Cost 10%Up

Case B (Foreign Funds: PERSERO, Domestic Funds: GOI)

	FIRR	Remarks
Original	3.3%	
Sensitivity Analysis(1)	2.3%	Revenue 10%Down
Sensitivity Analysis(2)	2.4%	Cost 10%Up
Sensitivity Analysis(3)	1.3%	Revenue 10%Down, Cost 10%Up

Case C (Foreign Funds: GOI, Domestic Funds: PERSERO)

	FIRR	Remarks
Original	5.4%	
Sensitivity Analysis(1)	4.2%	Revenue 10%Down
Sensitivity Analysis(2)	4.4%	Cost 10%Up
Sensitivity Analysis(3)	3.2%	Revenue 10%Down, Cost 10%Up

Case D (Foreign Funds: GOI, Domestic Funds: GOI)

	FIRR	Remarks
Original	7.5%	
Sensitivity Analysis(1)	6.4%	Revenue 10%Down
Sensitivity Analysis(2)	6.5%	Cost 10%Up
Sensitivity Analysis(3)	5.4%	Revenue 10%Down, Cost 10%Up

E. Financial Soundness of the Port Management Body

33. Case C and Case D which are judged to be feasible by FIRR analysis, are appraised from the viewpoint of financial soundness of the implementation body. The projected financial statement for the project and financial indicators are shown in Appendix 12-4.

34. The financial indicators of both cases keep the preferable levels, that is working ratio keeps below 50% after 2000 and operating ratio keeps below 70% after 2003.

35. However, regarding Case C in which domestic funds are the responsibility of PERSERO IV, it takes 21 years after starting operation to clear cumulative deficit. Also, in 2009 when replacement invest is required, PERSERO IV will still have Rp 7 billion of cumulative deficit. It means PERSERO IV will have to bear a considerable financial burden in Case C.

36. On the other side, regarding Case D in which initial investment costs are obligated to the government, it takes nine years after starting operation to clear cumulative deficit. Therefore, taking account of financial burden on PERSERO IV in Case C, Case D could be recommended as the financially feasible case.

F. Conclusion

37. Taking account that current tariff level is determined from the general point of view of promoting shipping in this area, low level of FIRR is unavoidable.

38. Judging from the above analysis, the project can only be regarded as financially feasible if the government funds are raised in the above manner (Case D) under current tariff level.

39. However, PERSERO IV should make efforts to secure forecast cargo volume by port sales, to improve port operation efficiency and to reduce operating expenses constantly.

PART II

FEASIBILITY STUDY OF PORT OF KUPANG

Chapter 1 SOCIO-ECONOMIC PROFILE OF EAST NUSA TENGGARA

A. Geographical Features

Topography

1. East Nusa Tenggara is an archipelagic province made up of three big islands namely Sumba, Timor and Flores, and other hundreds of small and medium islands. Then the extent of mainland region is approximately 47,000 km2 and the profile of topography is hilly / mountainous, where 70% of the mainland extent has slope of above 50°.

2. Approximately 33.7% of the region's land area is suitable for agriculture, however only 2.6% of that land area is suitable for wet agriculture, and the rest, namely 31.1%, is suitable for dry agriculture. Also approximately 34% of the total extent (1,616,000 HA) constitutes critical land both in and out of forest region.

Climate

3. Nusa Tenggara Timur has a tropical climate which is characterized by long dry season (about eight or nine months) and temperatures range from 20° to 34°. During the short rainy season, precipitation reaches minimum 800 millimeters and maximum 3,000 millimeters and there are 100 rainy days per annum on average.

B. Administrative Subdivision

Local government

4. In Indonesia, there are 27 Provinces (Propinsi) as the first class local governments and under their jurisdiction there are Regency (Kabupaten) and Municipality (Kotamadya) as the second class local government. Also Subdistrict (Kecamatan) and Village (Kelurahan) function as lower local administrative organizations.

Number of local governments

5. The administrative area of East Nusa Tenggara covers 12 Regencies, 98 Sub-districts and 97 Villages.

C. Demographic Features

6. Based on International Population Survey 1985, the population of East Nusa Tenggara was 3,061,224 and the growth rate(1980-1985) was 2.26% per annum. Based on the Census in 1990, the population was 3,268,644 and the average growth rate

during 1980-1990 was 1.98%. Also there are approximately 30 ethnic groups with unequally distributed pattern.

7. The high population growth is caused by the fact that the birth rate is still high, namely 3.17%, while the death rate has decreased to 1.25%. Also, the incoming migration rate outweighs the outgoing that as shown in Table 1-1. To cope with this situation, the creation of jobs through promotion of the local development plan will continue to be an important issue for this Province.

Table 1-1 Population Growth and Density

Region	Population			Area	Density
	1980	1985	1990	(km2)	(Person/km2)
East Nusa Tenggara	2,737,166	3,061,244	3,268,644	47,399.9	69
Kupang	403,167	470,805	522,944	7,388.6	71
Timor Tengah Selatan	289,655	330,803	348,067	3,947.0	88
Timor Tengah Utara	134,092	149,660	163,052	2,669.7	61
Belu	181,073	204,385	216,060	2,445.6	88
Alor	124,948	133,606	144,629	2,864.6	50
Flores Timur	257,687	270,135	265,759	3,079.2	86
Sikka	219,656	239,206	246,867	1,731.9	143
Ende	201,609	214,605	218,841	2,046.6	107
Ngada	172,575	190,354	198,100	3,037.9	65
Manggarai	397,525	450,683	499,458	7,136.4	70
Sumba Timur	123,078	140,373	152,946	4,051.9	38
Sumba Barat	232,101	266,629	291,921	7,000.5	42
	1971-80	1980-85	1985-90		
Crude Birth Rate	3.54%	3.27%	3.17%		
Crude Death Rate	1.52%	1.41%	1.25%		
Net Migration	1.95%	2.26%	1.79%		

Source: Central Bureau Statistics of Nusa Tenggara Timur

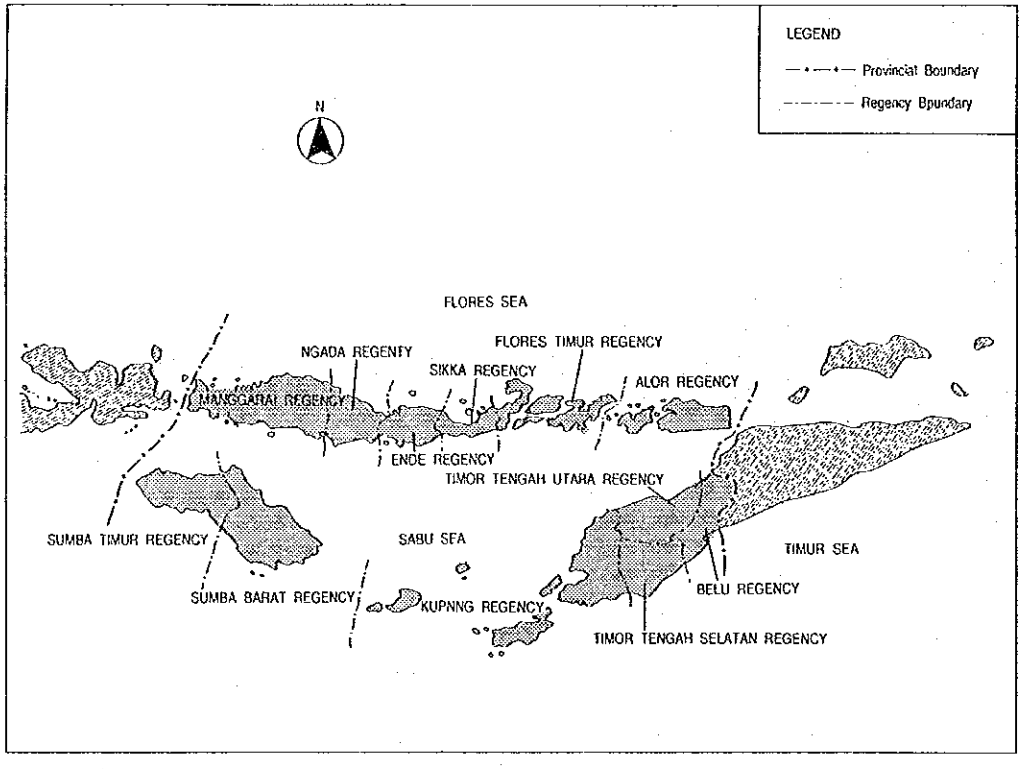


Figure 1-1 Administrative Division East Nusa Teneggara

D. Economic and Industrial Features

General

8. In Nusa Tenggara Timur, approximately 85% of the population earn their living in the agricultural sector. The agricultural sector plays a dominant role in the formation of the GRDP of this Province with its contribution of 50.1% in 1990 as shown in Table 1-2. On the other hand the industrial sector has grown very slowly as seen in its contribution of only 2% to GRDP.

Table 1-2 GRDP of East Nusa Tenggara Province at Constant Prices by Origin (1983-1990)

Unit: Rp Mn (1983 prices)

Industrial Origin	Year								Annual growth rate %
	1983	1984	1985	1986	1987	1988	1989	1990	
Agriculture	282,627	296,044	301,177	314,101	316,018	325,218	340,459	356,987	3.4%
Mining & Quarrying	2,043	2,613	2,848	2,426	3,129	3,325	3,720	4,006	10.1%
Manufacturing Industries	9,513	12,380	13,473	13,470	12,572	12,692	13,060	14,052	5.7%
Elect., Gas & Water supply	2,021	2,303	2,536	2,781	3,661	4,255	4,488	4,584	12.4%
Construction	14,387	15,948	16,994	15,542	19,130	21,708	23,718	25,306	8.4%
Trade, Resturant & Hotel	55,756	62,047	68,526	72,448	73,400	76,117	80,790	87,586	6.7%
Transport & Communication	29,804	34,639	35,113	40,486	46,992	52,395	56,892	69,516	12.9%
Banking & Other financial intermediaries	4,791	6,246	6,397	7,189	7,934	8,476	8,867	11,407	13.2%
Ownership of dwelling	10,384	10,446	10,606	10,880	10,942	11,098	11,283	11,696	1.7%
Public adm. & Defence	75,141	80,619	85,949	93,153	100,578	102,370	108,066	112,163	5.9%
Services	11,840	12,216	12,051	12,730	13,450	14,360	14,878	15,095	3.5%
Total	498,307	535,501	555,670	585,206	607,806	632,014	666,221	712,398	5.2%

Source: BIRO PUSAT STATISTIC JAKARTA-INDONESIA

9. Income per capita of East Nusa Tenggara is still low if compared to the National per capita. Income per capita of this Province in 1991 reached Rp. 384,166 (national income per capita reached Rp. 1,038,000 in the same year) or still below 40% of the average national income per capital.

10. As shown in Table 1-2, annual growth rate in basic industry sector such as electricity, gas, water supply and transport sector is pretty high, compared with that in agriculture sector.

11. In general, the growth of East Nusa Tenggara economy at the beginning of Fifth Five Year Development Planning (PELITA V) was higher than in PELITA IV. Also the target of economic development in REPELITA V is at least 5% per year, and 5.41% was achieved in 1989, 6.93% in 1990 and 5.59% in 1991.

Agriculture

12. The growth of food crop production in Nusa Tenggara Timur is shown in Table 1-3. It shows that food crop production tends to increase fluctuatingly. This fluctuation was caused by climatic problems and plant disease.

Table 1-3 Growth of Food Crops Production

Unit: Ton

Crops	1984	1985	1986	1987	1988	1989	1990
Wet Land Paddy	178,855	183,975	192,706	166,646	193,826	216,166	228,623
Dry Land Paddy	78,925	67,848	76,761	89,920	106,848	119,158	92,142
Maize	296,912	279,213	279,213	308,628	302,882	352,356	375,960
Soybeans	261	486	954	723	1,016	1,068	3,217
Peanut	11,517	15,661	13,503	8,180	7,783	7,412	7,796
Green Pea	15,454	16,759	15,761	13,607	12,073	14,130	-
Cassava	896,642	719,348	777,655	873,676	792,969	813,558	990,070
Sweet Potato	127,124	128,367	122,030	133,254	84,369	77,546	63,996

Source: Food Crop Dinas of Province of Nusa Tenggara Timur
- : Data not yet available

13. In East Nusa Tenggara several commercial crops such as coconut, coffee, cacao, cotton and cashew nut are planted dominantly as shown in Table 13-4 and exported to foreign countries. The export value of these commodities contribute 80 % of the total export value in East Nusa Tenggara in 1990, which is one of main sources of regional income and state foreign exchange.

Table 1-4 Growth of Commercial Crops Production

Unit: Ton

Crops	1984	1985	1986	1987	1988	1989	1990
Coconut	30,855	24,764	46,397	46,397	45,162	64,050	66,020
Coffee	9,272	9,033	9,893	9,647	9,548	11,258	12,364
Clove	56	46	65	107	131	147	174
Cashewnut	573	557	557	678	640	1,219	2,355
Cocoa	723	969	969	1,559	1,097	1,134	1,050
Candlenut	4,974	3,620	4,971	4,697	3,328	7,450	11,719
Kapok	4,081	3,794	4,356	4,185	4,191	4,624	4,986
Betelnut	3,278	3,681	1,450	3,644	3,804	3,828	3,854

Source: Estate Dinas of Province of Nusa Tenggara Timur

14. Also East Nusa Tenggara, especially Timor and Sumba is one of the main breeding grounds for livestock, such as poultry, pig, cattle, goat, horse and so on, in Indonesia. Also livestock is widely not only distributed to other Provinces but also exported to foreign countries.

Table 1-5 Number of Livestock in East Nusa Tenggara

Crops	1984	1985	1986	1987
Cattle	596,431	611,855	641,674	657,716
Buffalo	175,735	173,822	176,430	177,489
Horse	179,763	185,347	187,192	191,497
Goat	390,920	414,378	451,552	482,717
Sheep	86,815	89,427	91,662	95,287
Pig	996,381	1,056,163	1,118,121	1,185,208
Poultry	4,324,078	4,865,645	4,978,972	5,133,319
Duck	111,931	124,265	147,463	162,062

Source: Central Bureau of Statistics of Nusa Tenggara Timur

Fishery

15. The potential of fishery in East Nusa Tenggara is sufficiently high. In particular, the fishery of Exclusive Economic Zone (ZEE) has a continuing catch capacity of approximately 240,000 tons per year, though the actual catch volume was only 53,765.8 ton in 1990. Therefore, utilization of sea resource has reached only 22.4% of the potential. Viewing that the availability of agriculture land is limited in future, sea fishery constitutes one of the main alternatives to develop this Province.

Forestry

16. In East Nusa Tenggara, forestry has a high potential for development. Sandal wood and red wood products such as oil, crafts and so on are the main export product. To export sandal wood products directly and regularly, the shipping route, Kupang - Darwin - Hong Kong and United States of America, has been opened. Also, non-wood products such as tamarind, honey and rattan are traded inter islands from East Nusa Tenggara.

Mining

17. East Nusa Tenggara has six kinds of mineral deposit such as gold, silver, copper, manganese, lead and nickel, however the number of deposits remain unexploited. In addition, industrial materials such as limestone, clay, kaolin, quart sand, barite, sulfur, gypsum, and phosphate have been discovered in East Nusa Tenggara but except for limestone and clay as cement industrial raw materials and barite, most of these deposits remain unexploited.

Tourism

18. There are a lot of tourism attractions in East Nusa Tenggara such as marine tourism attractions like Pede Beach in Labuan Bajo and Sea Park of 17 Islands in Rinug - Ngada. Also, there are the other objects such as race animal or reptile species such as the Komodo Dragon in Komodo islands, the three colors lake in Ende and various archeological sites and local cultural tourism sites such as Pasola Kodi (West Sumba Regency) and Caci (Manggarai Regency). The number of tourists who

visit East Nusa Tenggara increased by six times from 1985 to 1990, namely from 10,085 person in 1985 to 61,515 persons in 1990 .

Table 1-6 Number of Overseas and Domestic Tourists to Visit East Nusa Tenggara

Tourists	1985	1986	1987	1988	1989	1990
Overseas	4,075	6,025	8,050	12,029	18,351	21,995
Domestic	6,010	21,761	24,298	35,046	33,210	39,520
Total	10,085	27,786	32,348	47,075	51,561	61,515

Source: Tourism Dinas of Nusa Tenggara Timur

Industry

19. The industrial activities in East Nusa Tenggara are generally sustained by small scale business and home industry including handicraft such as carving, shellfish, weaving and so on. The only industry classified as big industry in East Nusa Tenggara is Kupang Cement Factory which has a production capacity 120,000 ton/year. Product of Kupang Cement is shipped to West Nusa Tenggara, East Timor as well as East Nusa Tenggara.

20. It is planned in this province that industries processing the agricultural products (food crops, commercial crops and fishery) and forestry products which are still transported inter island in the form of raw material up to present, be developed so as to maximize additional value to region and enhance resident's income.

E. Infrastructure

Road

21. As an archipelagic province, East Nusa Tenggara needs a transportation and communication network to cover the whole area of the province. Therefore the provincial government of East Nusa Tenggara has made every endeavor to establish road network infrastructure as well as sea and air transportation. The road network can be observed in the following table.

Table 1-7 Road Conditions in East Nusa Tenggara

Road Status	Length (Km)	Type of Surface			Surface condition		
		Asphalted	Gravel	Earth	Good	Moderate	Bad
State road	1178.78	1128.78	50.28	-	739.1	373.88	65.8
		95.76%	4.27%	0.00%	62.70%	31.72%	5.58%
Provincial road	1688.75	844.01	787.01	57.92	614.2	884.82	189.92
		49.98%	46.60%	3.43%	36.37%	52.39%	11.25%
District road	11477.44	1470.6	3478.92	6527.92	1668	3342.74	6466.79
		12.81%	30.31%	56.88%	14.53%	29.12%	56.34%
Total	14344.97	3443.39	4316.21	6585.84	3021.3	4601.44	6722.51
		24.00%	30.09%	45.91%	21.06%	32.08%	46.86%

Source: Provincial Public Work Office of Nusa Tenggara Timur

22. The problems of road conditions are described bellow.
(i) There are many bridges and roads in heavily damaged condition.
(ii) About 46% of the road network is unpaved; for the most part these roads cannot be used during the rainy season.
(iii) Shortage of equipment and facilities for traffic control and passenger safety.

23. To support the National Program of main land traffic route of Banda Ache (Province of Ache in Western Indonesia) - Los Palos (Province of East Timor in Eastern Indonesia), together with the establishment of landways transportation sector, provincial government of East Nusa Tenggara has also established local ferry lines such as Kupang - Larantuka, Kupang - Pantai Baru, Kupang - Kalabahi, Kupang - Ende and Larantuka - Lewoleba - Balauring - Kabir. Also, there are three ferry wharves at present, namely, in Kupang, Larantuka and Bajo.

Port

24. There are 29 public ports in East Nusa Tenggara, of which five are managed by PERSERO, and the other 24 ports are under KANWIL management as shown in Table 1-8. In addition, there are 16 oil ports and fishery ports.

Table 1-8 Composition of Port in East Nusa Tenggara

Commercial port									
	Kupang	Waingap	Ende	Maumere	Kalabahi				
Non-commercial port									
Mother port	Larantuka	Reo	Waikelo	Atapupu	Baranusa	Baa	Seba	Marapokot	Labuhan Bajo
Working unit	Waiwerang Balauring Lewoleba	Robek	Rua Baing	Wini	Kabir Kolana Maritaing	Papela Oelaba Batutua Ndao Naikliu	Raijua Biu	Marole Mborong Aimere	Nangailili

Source: DGSC

Airport

25. Air transportation sector contributes greatly to the convenience of residents and industries in East Nusa Tenggara. There are 14 airports spread throughout this province and only the districts of Timor Tengah Selatan and Timor Tengah Utara are without an airport. The airports are divided into three classes according to capacity. There are two airports classified as class II, three airports as class III and nine airports as pioneer airports. The main problems faced by air transportation sector are lack of asphalting at some airports, inadequate terminal facilities and inadequate navigation/ communication equipment.

Chapter 2 PRESENT SITUATION OF THE PORT OF KUPANG

A. Kupang Regency

General

1. Kupang regency area forms a large part of Timor Island and several small islands, namely Semau Island, Rote Island and Sabu Island. This regency is located at the west end of Timor Island. This regency is under the East Nusa Tenggara province. The area of this regency is 7,338.63 km2 (15.5 % of East Nusa Tenggara province total land area). According to the 1990 population census, this regency has a total population of 522,944 with an average ratio of 71 persons per square kilometer.

2. The climate in this area is tropical with high temperatures and high humidity. There are three climate condition observation stations in this regency. According to the observation data, average temperature in this regency is about 27 degrees centigrade. There are around 100 rainy days annually and average relative humidity is about 80 %.

Land use

3. The present land use of this regency is shown in Table 2-1. The types of land use in this regency are classified into rural and urban land use. For the area of Kupang administrative city, namely North Kupang sub-district and South Kupang sub-district, land use is of an urban nature, whereas the land use of other sub-districts is of a rural nature.

Table 2-1 Present Land Use in Kupang Regency

Utilization	Area (ha)	Share (%)
Rice field	11,871	1.62
Dry field	20,868	2.84
Unirrigated field	13,499	1.84
Agricultural field	546	0.07
Plantation	1,687	0.23
Forest	443,182	60.39
Underbrush	62,644	8.54
Swamp, Lake	4,813	0.66
Savannah	147,067	20.04
Villege	7,229	0.99
Urban area	247	0.03
Others	20,210	2.75
Total	733,863	100.00

Source: BAPPEDA Kupang

Port related industries

4. The port of Kupang is the principal port in the East Nusa Tenggara province. Therefore, many kinds of port related industries are located in this regency. The major port related industries are as follows:

a) Pertamina (Oil industry)
b) Cement industry

a) Pertamina (Oil industry)

5. Pertamina has a jetty and storage tanks in the port area of Kupang port. Pertamina will need neither another jetty, nor additional storage tanks. Pertamina will need, however, land to erect a buffer zone and to improve safety.

b) Cement industry

6. There is a cement factory named P.T. Cemen Kupang in this regency. This factory belongs to the central government. The product of this factory is shipped to West Nusa Tenggara, East Timor, as well as East Nusa Tenggara.

B. Shipping Routes

General

7. The East Nusa Tenggara province is the important place for sea transportation and this province is connected to the inside of the province, other provinces and foreign countries by ship. Kupang regency has some ports, i.e. the port of Kupang (sea port), Kupang ferry terminal, fishing port, and some private ports.

8. The port of Kupang is a provincial hub port, therefore, this port has various shipping routes. For example, this port is connected to a lot of regions by international shipping route, interisland shipping route, Pelni shipping route and Perintis shipping route.

International shipping route

9. Kupang regency is located near Australia. Kupang regency is connected to Darwin (Australia) by air and by ship. According to the ship call record at Kupang Port, two kinds of ships call this port. The other international shipping route is "Singapore - Kupang - Singapore route".

Pelni passenger

10. Pelni passenger ships call at the port of Kupang. The following shipping route is operated in 1993.

a) Lembar -> Surabaya -> Banjarmasin -> Surabaya -> Benoa -> Bima -> Waingapu -> Ende -> Kupang -> Dilli -> Kalabahi -> Maumere -> Uj.Pandang -> Maumere -> Kalabahi -> Dilli -> Kupang -> Ende -> Waingapu -> Bima (Ship name: KM.KELIMUTU)

Perintis

11. The port of Kupang is one of the base ports at which the Perintis lines call. In 1993 the following shipping routes are operated;

a) Uj.Pandang -> Selayar -> Jampea -> Bonerate -> Kalaotoa -> Reo -> Maumere -> Larantuka -> Kupang
b) Kupang -> Ndao -> Sabu -> Raijua -> Waingapu -> Maumbawa -> Waikelo -> Labuhan Bajo -> Waikelo -> Maumbawa -> Waingapu -> Raijua -> Sabu -> Ndao -> Kupang
c) Kupang -> Oekusi -> Kalabahi -> Maritaim -> Dilli -> Lirang -> Kisar -> Wetar -> Dilli -> Maritaim -> Kalabahi -> Atapupu -> Kupang
d) Kupang -> Larantuka -> Waiwerang -> Lewoleba -> Balauring -> Baranusa -> Kalabahi -> Lirang -> Kisar -> Kalabahi -> Wini -> Kupang
e) Kupang -> Maumere -> Palue -> Marapokot -> Reo -> Labuhan Bajo -> Bima -> Reo -> Marapokot -> Palue -> Maumere -> Kupang
f) Dilli -> Kupang -> Kalabahi -> Lirang -> Kisar -> Romang -> Damar -> Tepa -> Saumlaki -> Tual -> Ambon

Container

12. The port of Kupang began to handle container cargoes in 1990. The empty containers come from Darwin, and go to Singapore, Hong Kong and Taiwan stuffed with sandalwood. The container ship which carries above containers comes to the port of Kupang once a month from Darwin , discharging 12 to 15 units of empty containers and loading stuffed containers.

Ferry

13. Kupang opened the following five ferry routes in June 1992. The main islands around Kupang regency are connected by these ferry routes. Thus this ferry service is one of the most important transportation means for people in this regency.

a) Kupang - Larantuka route
b) Kupang - Kalabahi route
c) Kupang - Pantai Baru route
d) Kupang - Sabu route
e) Kupang - Ende route
f) Kupang - Naikliu route

C. Port Facilities

Port limits

14. The port limits of Kupang are as follows:

a) Land area ----- 41.45 ha
b) Water area ----- 823.72 ha

15. Above areas are managed by PERSERO. But some parts of above areas are used by Pertamina, fishery port and animal quarantine. (see Figure 2-1)

Berthing facilities

16. The berthing facilities at the port of Kupang are functionally classified as shown below.

a) Interisland wharf

The interisland wharf (length: 223 m, water depth: -8.0 m) is the main berth of this port and is used by interisland vessels. The maximum allowable ship size is 10,000 DWT. This wharf consists of reinforced concrete deck on concrete piles.

b) Local wharf

The local wharf (length: 100 m, water depth: -6.0 m) is the second berth of this port and is used by local vessels, sailing vessels and passenger ships. The maximum allowable ship size is 2,000 DWT. This wharf consists of reinforced concrete deck on concrete piles.

c) Other berthing facilities

The fishery jetty is located on the south side of this port. This jetty consists of concrete causeway and wooden pier. Oil jetty managed by Pertamina is located on the south side of the fishery jetty. Furthermore, the ferry terminal is situated to 6 km south of this port.

Storage facilities

17. There are two transit sheds (1,500 m^2, 1,000 m^2) behind the interisland wharf. This port also has 4,950 m^2 of asphalt paved open storage and 13,785 m^2 of open storage which is paved with lime stone. Furthermore, this port already has a 1,265 m^2 container yard which is paved with concrete blocks.

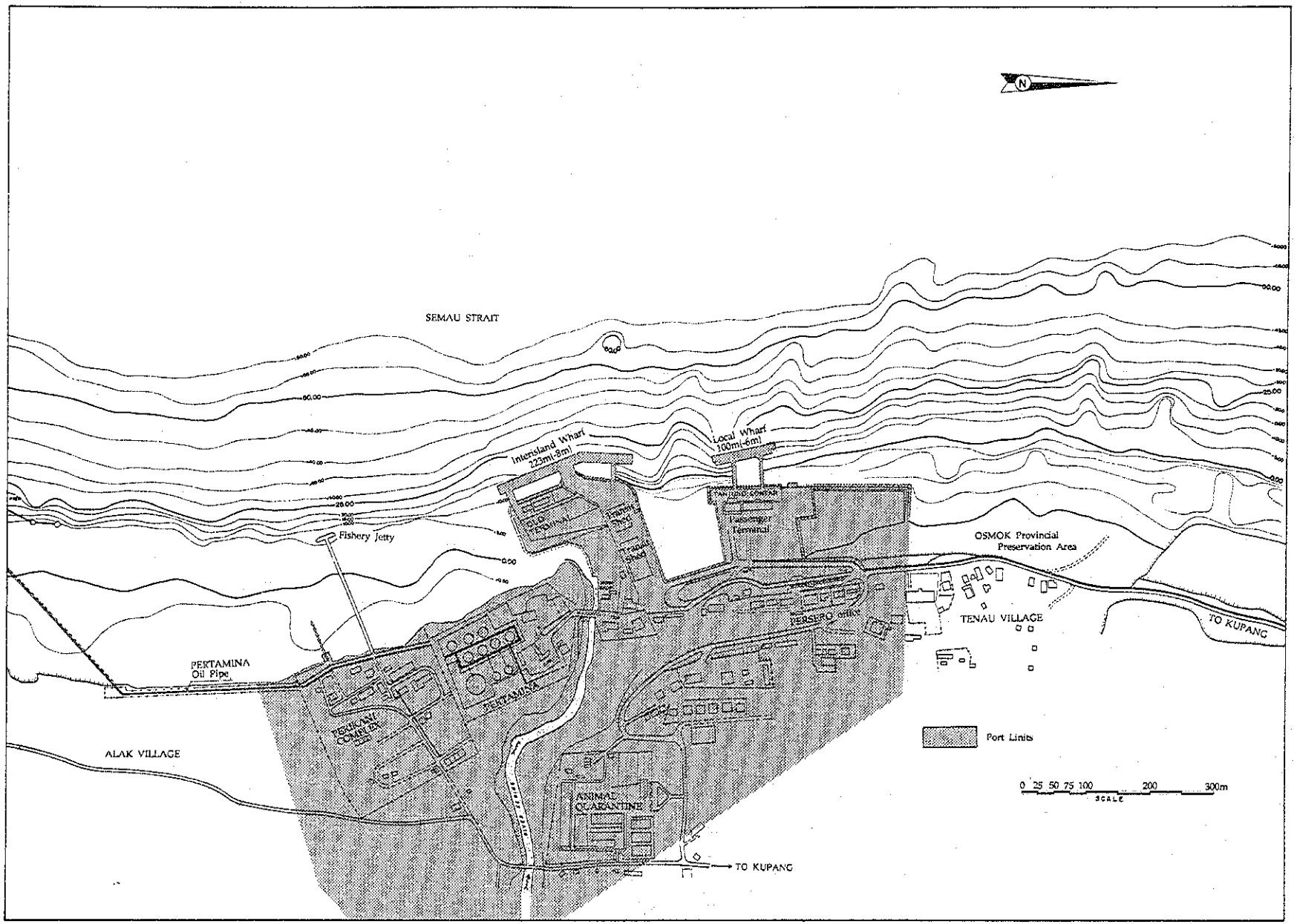


Figure 2-1 Existing Facilities of Kupang Port

D. Cargo and Passenger Traffic through the Port

Cargo handling volume

18. Table 2-2 and Figure 2-2 show cargo volume handled at the public wharves of the port of Kupang during 1984 - 1992. Pertamina's cargo is excluded from both the table and the figure.

19. A total of 309,582 tons of cargo was handled at this port in 1992, and 95% of the total cargo had domestic origin and destination. Like at other public ports in Eastern Indonesia, unloading cargo was dominant in terms of cargo volume, and accounted for two-thirds of the total cargo volume of the port of Kupang in 1992.

20. Total cargo traffic has been increasing at an annual growth rate of 12 % from 1984 to 1992; by category, 17% for the domestic loading, and 9% for the domestic unloading.

21. Table 2-3 shows commodity-wise cargo volume handled during the same period. General cargo has been a main component (32% in 1992), followed by cement (23%) and rice (14%). Coal (9%) has been domestically imported for fuel for both the cement production and power generation. Clinker (10%) has also been domestically imported to compensate the deficit between cement production capacity and actual demand.

22. From the statement above, it is clear that the port of Kupang has two kinds of functions. The first function is as a general cargo port servicing local people and sustaining daily activities. The port is importing foodstuffs and daily necessities from East Java and other islands.

23. The other major function of the port is an industrial port function. About half of the cargo volume of the Kupang port is either raw material/fuel for cement production or cement product itself. Industrial function of the port of Kupang is distinguished among the major public ports in Eastern Indonesia.

24. Table 2-4 shows packing type of cargo at the port of Kupang. Thirty-nine percent of the total in 1992 was bag cargo, which includes cement and rice. Containers have been handled at the port since 1990. Sandalwood and its products have been directly shipped to Singapore and Hong Kong by containers although the volume is minimal so far. Domestic containers have also been transported from Surabaya recently.

Trading partners of domestic cargoes

25. Table 2-5 is the summary result of the ship call record in October 1992. The ship call record contains information on "the first port of call out", "the last port of call in", and volume of cargo loaded and unloaded at the port of Kupang. The ship call record does not necessarily reveal true origins and destinations of cargo movement, but shows the outline of the cargo traffic.

Table 2-2 Port Tonnage Traffic through Port of Kupang

Year	Import (ton)	Export (ton)	Sub-total (ton)	Unloading (ton)	Loading (ton)	Sub-total (ton)	Total (ton)	Animal (No)
1984	2,133		2,133	101,177	26,127	127,304	129,436	43,748
1985	6,950		6,950	115,842	36,340	152,182	159,132	37,604
1986	4,803		4,803	166,543	25,987	192,530	197,333	43,609
1987	5,819	17	5,836	151,603	25,512	177,115	182,952	36,979
1988	9,919		9,919	141,240	43,485	184,725	194,644	44,017
1989	15,983		15,983	126,959	45,491	172,450	188,433	50,743
1990	9,515	86	9,601	164,092	55,651	219,743	229,344	54,489
1991	7,058	940	7,998	179,136	70,656	249,792	257,790	37,953
1992	15,065	1,086	16,151	203,039	90,392	293,431	309,582	25,320

Source : PERSERO of Kupang
Remark : These data show Port Tonnage Traffic of Public Wharves.

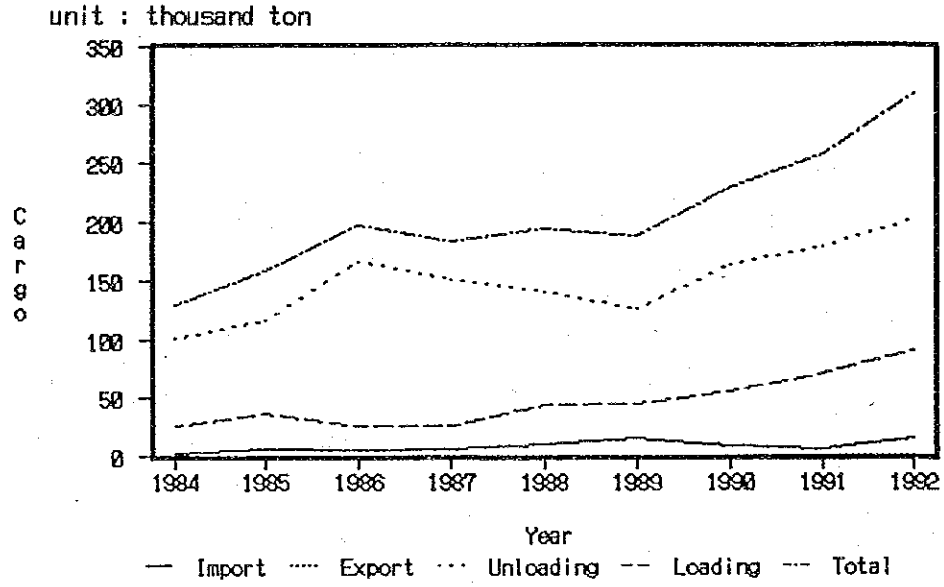


Figure 2-2 Cargo Volume at Kupang Port

Table 2-3 Commodity-wise Cargo Volume at Kupang Port

Unit: ton

No	Commodity	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	Rice	26,381	20,951	35,648	29,081	35,093	34,024	36,309	28,021	42,474
2	Sugar	4,360	3,903	3,869	2,762	2,678	2,976	2,988	3,310	2,458
3	Wheat	2,376	4,704	3,869	2,825	3,341	3,256	3,425	3,087	3,351
4	Maize	0	0	1,058	781	48	0	0	0	0
5	Fertilizer	110	5,610	3,259	6,359	5,164	2,202	2,874	3,409	2,520
6	Wood	0	0	0	0	10,600	12,205	7,591	7,644	7,313
7	Asphalt	12,390	9,800	0	4,452	4,371	11,635	9,323	7,350	13,095
8	Coal	6,815	9,550	13,000	10,000	15,000	11,800	16,898	20,850	28,400
9	Gypsum	0	3,150	3,150	0	5,500	1,371	3,795	7,710	8,498
10	Clinker	0	0	12,606	0	8,312	0	16,868	24,278	29,804
11	Iron Sand	0	0	1,189	0	0	0	0	0	2,772
12	Cement	29,664	22,775	16,898	36,072	33,533	36,400	51,014	61,646	71,031
13	G.Cargo	47,442	79,319	102,794	90,771	71,004	71,996	78,259	76,455	97,866
	Total	129,537	159,762	197,333	182,803	194,644	197,865	229,344	243,760	309,582

Source : PERSERO of Kupang