14. Conventional wharves will require open space of about 9,000 m2 for container storage in 2000. Since the port of Bitung already has 4,000 m2 of container yard (paved concrete blocks) and about 6,000 m2 of open storage area at present, an additional area for container yard is not necessary to be developed in 2000.

15. On the other hand, a new container yard has to be developed at the new container terminal area. The required number of ground slots at the container yard in the year 2000 is estimated at more than 400. The terminal will require about 15,000 m2 of container yard in 2000.

Other facility

16. Annual handling volume of containerized cargo through Container Freight Station (CFS) is estimated at 63,000 tons in 2000, and the terminal will require an area of about 1,800 m2 for the CFS. An area of 2,500 m2 will be needed for a terminal office, maintenance shop, fumigation yard, washing and cleaning yard, custom inspection yard, and so on. In addition, the terminal will require an area of about 3,500 m2 for the parking area near the gate of the container terminal in 2000.

D. Access Roads

17. Because the port of Bitung is located near downtown Bitung, traffic generated from port activities sometimes causes traffic congestion near the port gates. In order to achieve harmonized development between the city and port, traffic to/from the port should be treated appropriately.

18. A new access road of 810 m in total length is proposed to attain the above goal. The route of this access road is from the gate of the container terminal to the end of existing main road. This access road runs along the port limit. Since the proposed land for the new access road belongs to PERSERO IV, it is anticipated that little effort will be required to acquire and clear the above land.

Passway along Interisland Wharf

19. Development of a passway along Interisland Wharf is necessary to smoothen the above traffic. Existing apron of Interisland Wharf should be widened, and the passway of 10 m in width should be developed along the apron. Improvement and development of these facilities will also facilitate utilization of Interisland Wharf.

E. Site Selection for the Port Development

20. Prior to the present study, JICA implemented a feasibility study on an expansion project of the Bitung port in 1978. In this past JICA study, six sites in the vicinity of the present Bitung port were evaluated in depth from both socioeconomic and engineering aspects.

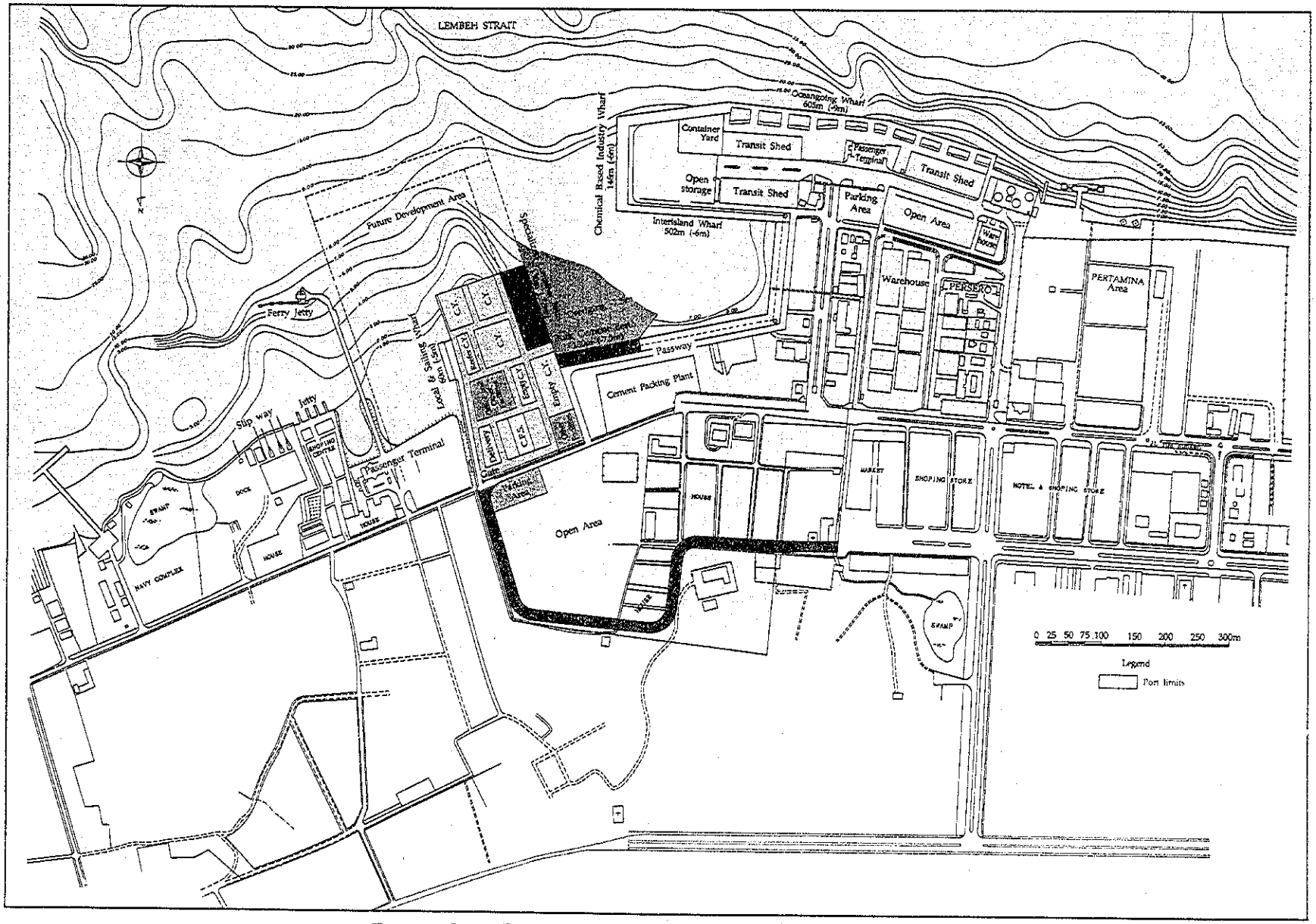


Figure 6-1 Bitung Port Development (Alternative 1)

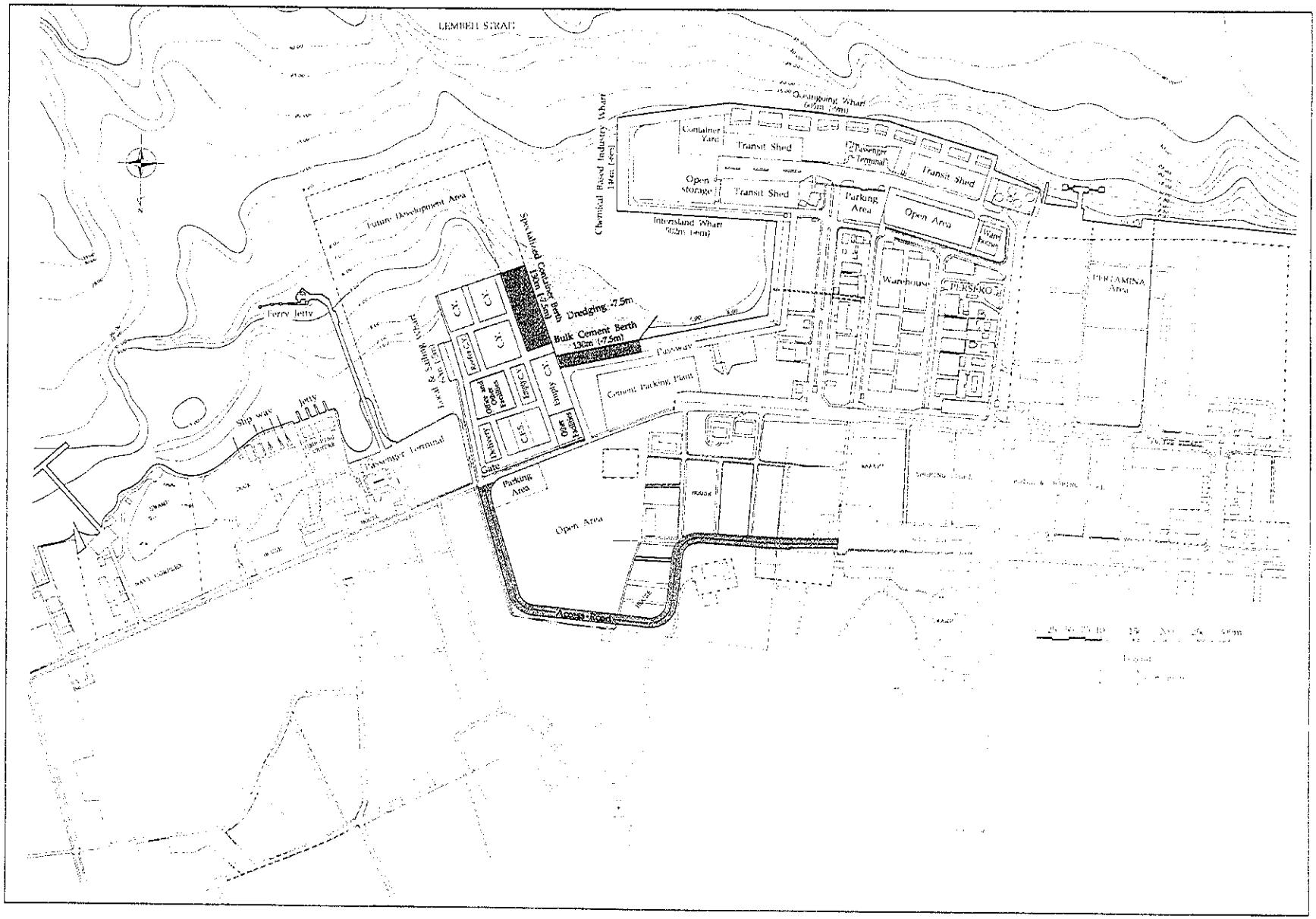


Figure 6-1 Bitung Port Development (Alternative 1)

21. Bitung East, which is one of the possible sites, is located next to the existing port facilities where deep and calm water area is found, and is advantageous for the realization of efficient port management and operation. After careful examination, Bitung East was selected in the previous study as the most suitable site for the new port facilities by the year 2000.

22. The evaluation and conclusion of the past JICA study seems to be reasonable even today, and the present JICA study team supports the conclusion of the site selection studied in 1978.

F. Preparation of Alternative Layout Plans

23. In order to ensure the most adequate layout among various ideas within the constraints, the following two alternatives were proposed:

Alternative 1: This alternative is based on an idea to continue operating the existing Local wharf. The required area for container terminal is practically secured in the existing reserved area. The layout plan is shown in Figure 6-1.

Alternative 2: This alternative is based on an idea to cease operating the existing Local Wharf. The required area for container terminal is practically secured in the new reclamation area.

G. Evaluation of the Alternative Layout Plans

24. Alternative 1 has the following inherent advantages;

(1) The existing Local Wharf can 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.

25. 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

26. The proposed berths will be used by medium-size vessels, which require wave height of less than 0.5 m as a condition for loading or unloading. Probability of occurrence of wave height of more than 0.5 m at these berths is only 0.1%; 99.9% is workable.

I. Cargo Handling Equipment and Working Vessels

27. 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
(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

28. 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

29. Suitable site for the container terminal after 2000 is the area adjacent to the proposed container berth, which is located between the Chemical 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.

30. After land transportation problems are solved, Lembeh island can be best utilized as a distribution or transshipment center for bulky 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 economy 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 and Facilities to be Designed

1. The new port structure for container berth is proposed to function as a multi-purpose wharf for the present and as a container wharf in future. The wharf should be of a rigid structure which can bear the load of a variety of cargo handling equipment used on the port structure.

2. Bitung area is within the Seismic Zone II where an earthquake of large magnitude takes place frequently. Seabed in the port area is composed of thick loose sandy layers. Accordingly, the proposed port structure should be of an earthquake-resistant type.

3. In selecting a structural type for the proposed port facilities, calmness at the basin should be taken into consideration.

4. Locally produced materials should be used in the construction works to the maximum extent, and precast members manufactured on land should be used to minimize the offshore works.

5. The proposed major facilities for the Bitung Port are as follows:

Specialized Container terminal:		Berth, container yard, CFS, parking area, revetment, and access road.
Bulk Cement berth	:	Berth, revetment and access road.

B. Design Conditions and Structural Type

6. Tide level at Bitung port is +1.90m at time of high water and ±0.00m at time of low water. Required water depth alongside the both container and cement berths is taken as -7.5m, and the required berth elevation of +3.00m is taken in accordance with the Design Criteria of D.G.S.C.

7. In general, seabed at the proposed construction site of the both berths is composed of upper layer of loose sand and lower layer of dense sand. However, elevation of the dense sand layer which is expected as the support for pile foundations differs at the respective sites; -40m at the container berth site and -28m at the cement berth site.

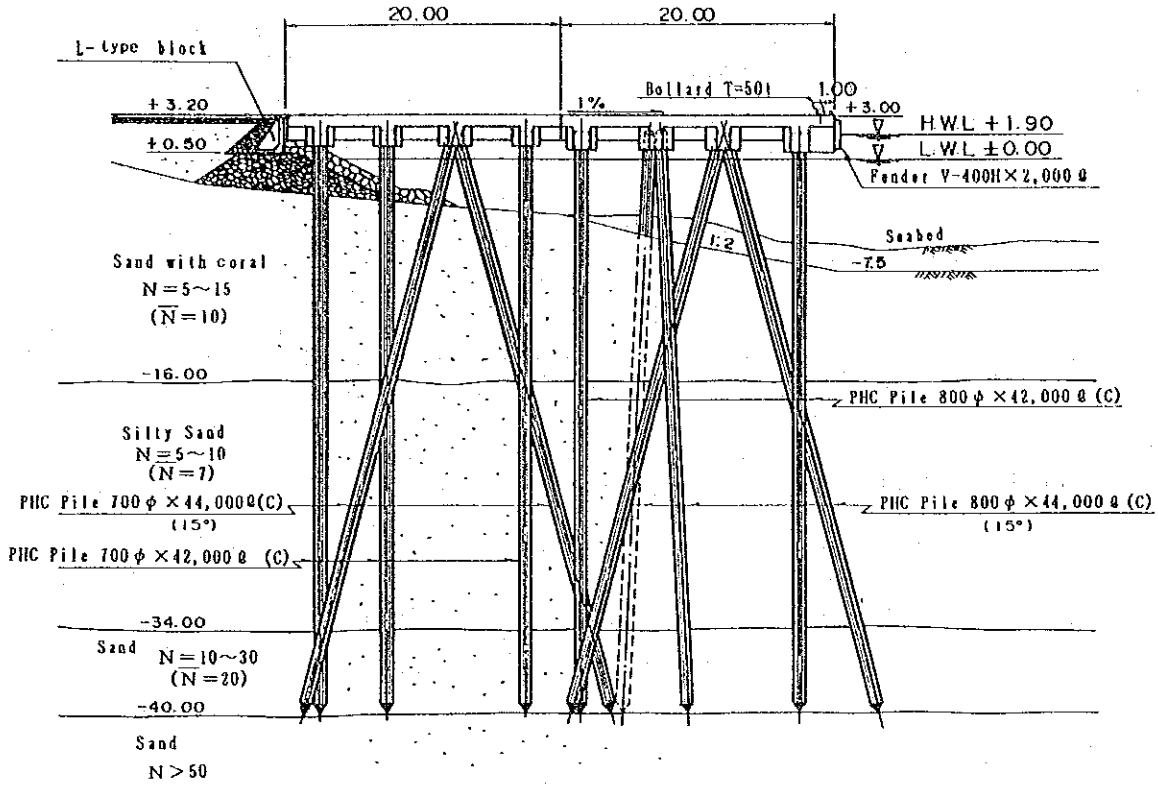
8. Governing design loads include the surcharge, earthquake factor and wheel load of cargo handling equipment. The surcharge on the berths is taken as 3 tons/m^2, and the earthquake factor of 0.15g is adopted in consideration of some additional factors to the regional earthquake factor of 0.09g. The design wheel load is determined based upon the maximum wheel load of the cargo handling equipment to be used on each berth.

9. As a result of comparative study on alternative structural types (pier type and gravity type) for the container and cement berths, pier type structure with pile foundations is selected by reason of calm basin at the construction sites, suitability with the existing soil condition, and economical construction cost. The standard

cross section of each berth is illustrated in Figure 7-1.

10. Container yard is so designed as to allow the stacking of stuffed container in 3 tiers, and the design of access road ensures the safe traffic of heavy vehicles.

(1) Specialized Container Berth



(2) Bulk Cement Berth

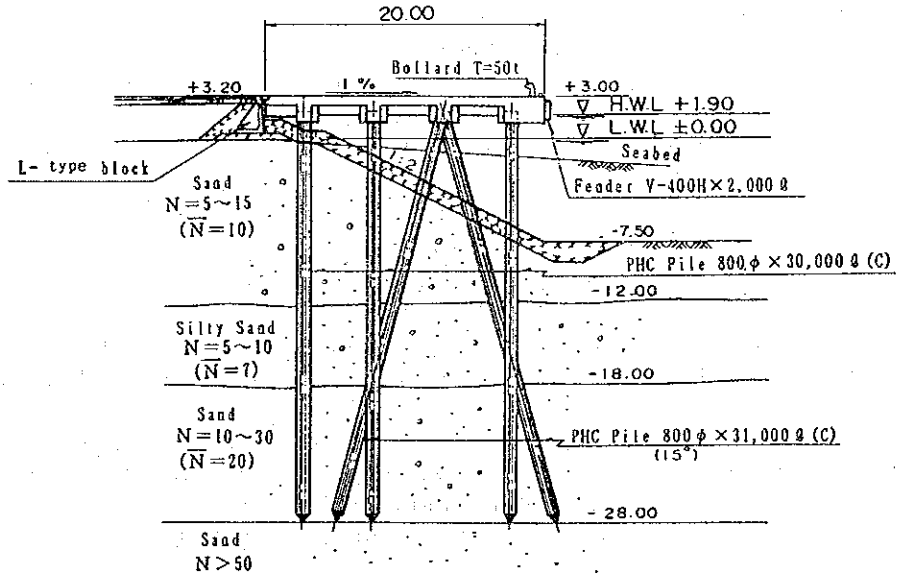


Figure 7-1 Standard Cross Section of Main Pier

Chapter 8 COST ESTIMATE AND CONSTRUCTION SCHEDULE

A. Basic Conditions for Cost Estimation and Construction Cost

1. Basic prices of materials, labor, work crafts and 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. Accordingly, the basic unit prices are as of May 1993.

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

US$1.00 = Rp.2,083 = ¥105.47 (¥1 = Rp.19.75)

3. 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 cost of civil and building works, procurement cost of equipment and craft, and engineering and supervision fee.

4. For the engineering and supervision fee, ten percent (10%) of the direct cost of 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.

5. 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, procurement cost of equipment and craft, engineering and supervision fee, and physical contingency.

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

7. Results of the cost estimation are shown in Table 8-1. From the Table the following is known:

Specialized Container berth: Rp. 52,197 million

Bulk Cement berth: Rp. 20,520 million

B. Construction Schedule

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

9. According to the estimated construction schedule, it takes two (2) years each to complete the construction of Specialized Container Berth and Bulk Cement Berth.

10. Figure 8-1 shows the construction schedule of the Specialized Container and Bulk Cement Berths, respectively. 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.

Table 8-1 Construction Cost

(1) Specialized Container Berth

Construction Item	Works	Quantity	Unit	Total Cost	Total LC	Total FC
I. Direct Cost				31,823.1	20,514.7	11,308.4
1-1. Mobilization and Preparation		1	L	700.0	700.0	-
1-2. Dredging		43,000	m^3	507.4	507.4	-
1-3. Reclamation	Revetment	400	m	1,889.6	1,889.6	-
	Reclamation	62,000	m^3	612.4	612.4	-
1-4. Specialized Container Berth	Main Pier	5,200	m^2	20,170.0	9,796.0	10,374.0
	Side Pier	1,600	m^2	2,167.5	1,644.4	523.1
	Container Yard	37,000	m^2	2,313.6	2,313.6	-
	Miscellaneous	1	L	2,129.5	1,718.2	411.3
	Road	486	m	1,333.1	1,333.1	-
II. Equipment and Craft		1	L	8,974.2	3,999.5	4,974.7
III. Engineering and Supervision		1	L	3,182.3	954.7	2,227.6
IV. Physical Contingency		1	L	3,472.3	3,546.8	925.5
V. VAT		1	L	4,745.2	4,745.2	-
Grand Total				52,197.2	32,761.0	19,436.2

(2) Bulk Cement Berth

Construction Item	Works	Quantity	Unit	Total Cost	Total LC	Total FC
I. Direct Cost				12,520.9	8,642.5	3,878.4
1-1. Mobilization and Preparation		1	L	700.0	700.0	-
1-2. Dredging		43,000	m^3	507.4	507.4	-
1-3. Revetment	Revetment	150	m	809.8	809.8	-
1-4. Bulk Cement Berth	Main Pier	2,600	m^2	7,038.9	3,571.8	3,467.1
	Yard	28,000	m^2	253.9	253.9	-
	Miscellaneous	1	L	988.6	577.3	411.3
	Road	324	m	2,222.3	2,222.3	-
II. Craft		1	L	3,402.5	3,402.5	-
III. Engineering and Supervision		1	L	1,252.0	375.6	876.4
IV. Physical Contingency		1	L	1,479.8	1,242.1	237.7
V. VAT		1	L	1,865.6	1,865.6	-
Grand Total				20,520.2	15,528.3	4,992.5

(1) Specialized Container Berth

Construction Item	Works	Quantity	Unit	Mar 1997	Mar 1998	Mar 1999	Mar 2000
				1st year	2nd year	3rd year	
1. Mobilization & Preparation		1	L				
2. Dredging		4,300	m^3		4M 400m^3/day		
3. Reclamation	Revetment	400	m		12M 1.3m/d		
	Reclamation	62,000	m^3		9M 300m^3/d		
4. Specialized Container Berth	Main Pier	5,200	m^2		10.5M 20m^2/d		
	Side Pier	1,600	m^2			2M 25m^2/d	
	Container Yard	37,000	m^3			12M 125m^2/d	
	Miscel-laneous	1	L			12M	
	Road	486	m			12M 1.6m/d	
5. Equipment & Craft		1	L			Build	Site
6. Engineering & Supervision		1	L	Engineering		Supervision	

Note: 1 Month (1M) = 25 days
: 1 Year = 300 days

(2) Bulk Cement Berth

Construction Item	Works	Quantity	Unit	Mar 1997	Mar 1998	Mar 1999	Mar 2000
				1st year	2nd year	3rd year	
1. Mobilization & Preparation		1	L				
2. Dredging		43,000	m^3		4M 400m^3/d		
3. Reclamation	Revetment	150	m		4M 1.3m/d		
4. Bulk Cement Berth	Main Pier	2,600	m^2		5.5M 20m^2/d		
	Yard	28,000	m^2			4.5M 250m^2/d	
	Miscel-laneous	1	L				
	Road	324	m			8M 1.6m/d	
5. Craft		1	L			Build	Site
6. Engineering & Supervision		1	L	Engineering		Supervision	

Note: 1 Month (1M) = 25 days

Figure 8-1 Construction Schedule

Chapter 9 ENVIRONMENTAL IMPACT ASSESSMENT

A. Basic Procedure of Environmental Impact Assessment

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. 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.

5. In this study, the target of environmental preservation was established as follows;

"The impact to environment will be permissibly small."

B. Impact Assessment of Construction Works

Water quality

6. A major indicator of water pollution caused by construction works is Suspended Solid (SS). In this case, the scale of construction works is not so large. Therefore, the volume of SS is limited and if silt protector is used in case of dredging, the diffusion of SS is cut more than 50 %. Thus it seems that the impact to water quality around Bitung port during the construction period will be permissibly small.

Other environmental components

7. In this study, other environmental components (Air quality, Noise, Vibration, Odor, Fauna, Flora, Wastes, Socio-culture and Socio-economy) were also assessed

based on the conditions of construction works at this port. It seems that the impact to all other environmental components will be permissibly small.

C. Impact assessment of existence of port

Coastal hydrology

8. In general, it is thought that tidal current is affected by existence of reclamation areas and breakwaters. 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.

9. "A depth averaged two dimensional hydrodynamic model" was applied. The result of simulation is shown in Figure 9-1. According to the result, 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.

Other environmental components

10. In this study, other environmental components (Water quality, Topography, Fauna, Flora, Scenic view, Socio-culture and Socio-economy) were also assessed based on the present conditions and the port development plan of this port. It seems that the impact to all other environmental components will be permissibly small.

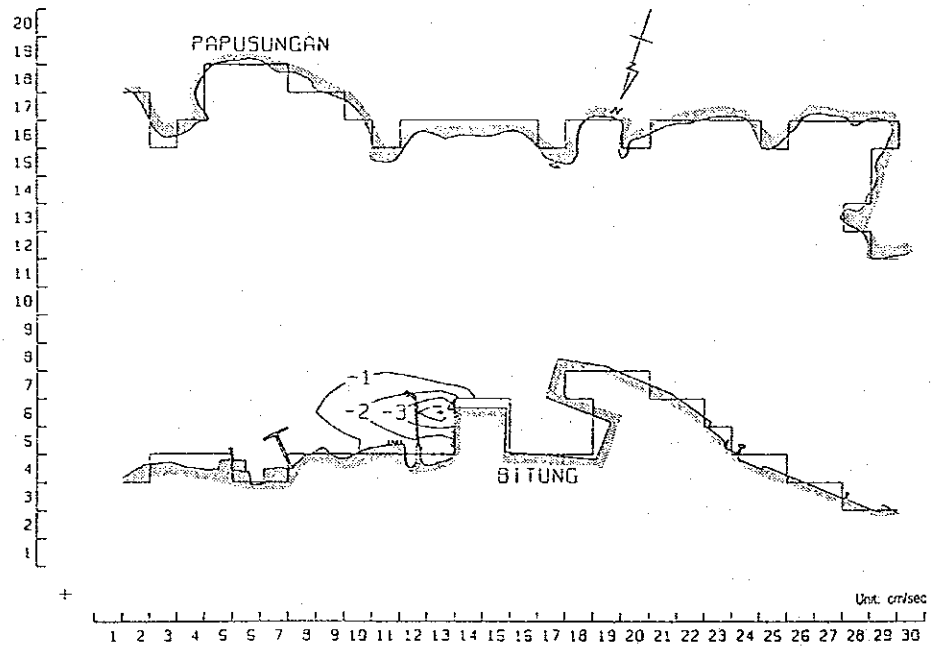


Figure 9-1 Tidal Current Velocity Difference [Case (Future-Present)]

D. Impact Assessment of Utilization of Port Facilities

Water quality

11. 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. In this study, computer simulation technique was applied.

12. "A depth averaged two dimensional diffusion model for passive materials" was applied. The result of the simulation is shown in Figure 9-2. According to the result, transition area of water quality will be limited and transition of concentration of COD will be maximum 2 mg/l. So it seems that the impact to water quality will be permissibly small.

Other environmental components

13. In this study, other environmental components (Air quality, Bottom conditions, Noise, Vibration, Odor, Topography, Fauna, Flora, Wastes, Socio-culture and Socio-economy) were also assessed based on the present conditions and the port development plan of this port. It seems that the impact to all other environmental components will be permissibly small.

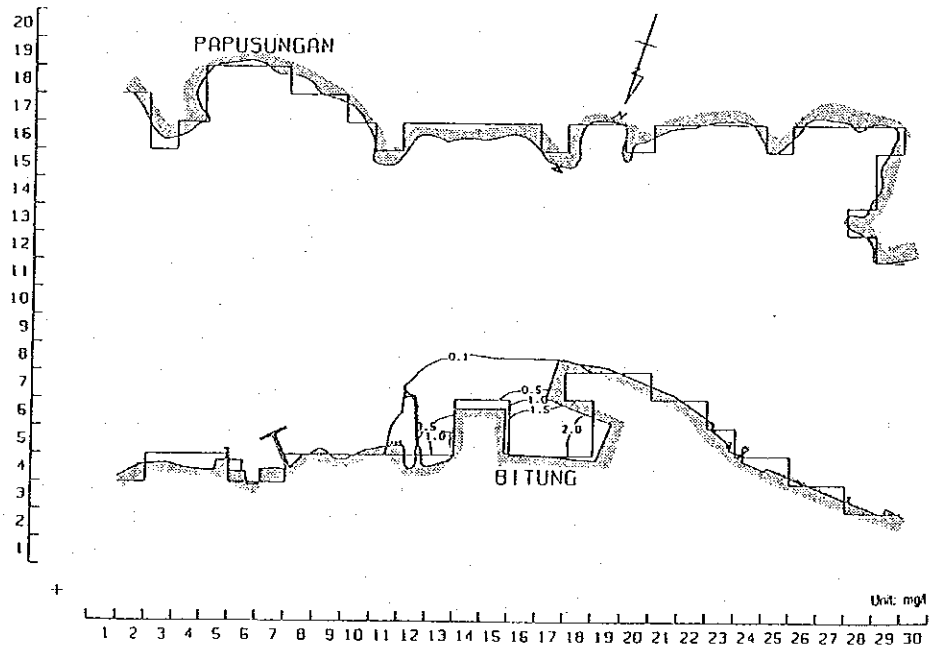


Figure 9-2 COD Concentration Difference [Case (Future-Present)]

E. Countermeasures for Environmental Preservation

14. According to the results of environmental impact assessment regarding the port development at Bitung port, countermeasures for environmental preservation are required to maintain the target of environmental preservation.

15. One of the most important countermeasures is as follows;

"The drainage generated by civic life should not flow into the closed port sea area."

Chapter 10 PORT MANAGEMENT AND OPERATION

1. To promote port use, it is essential to provide attractive port services to port users. From this viewpoint, we have examined problems in the port management and operations and made some recommendations.

Introduction of flexibility in gang formation for cargo handling

2. The current gang size for cargo handling consists of a total of 48 persons, and this gang formation is fixed regardless of the kinds of commodity and packing type of cargo. However 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.

Maintaining the cargo handling equipment in good condition

3. To realize rational cargo handling, the equipment must be properly maintained in good condition and must be utilized to the fullest extent. To accomplish this goal, it is necessary not only to inspect handling equipment regularly but also to stock those spare parts which are used often. Also more funds should be allocated for maintenance so as to put the handling equipment in better condition.

Training and improvement of working conditions for port labor

4. To adapt port laborers to the 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. Also 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.

Effective utilization of open yard

5. 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.

Specialization of the wharf step by step

6. 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.

Establishment of a new sub division to operate the Specialized Container Berth

7. To operate the new container terminal, new sub division which consists of about thirty stuffs should be established in PERSERO branch office.

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.

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.

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. In the cost-benefit analysis, 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.

"With & Without" case

7. 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.

C. Economic Prices

Economic prices of benefit item

8. 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.

Project costs

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

10. In the economic analysis, construction 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).

11. Since the maintenance costs , replacement costs and residual values include various indefinite elements, they are converted into economic prices by multiplying the SCF.

D. Evaluation

12. 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.

13. The base EIRR and the sensitivity analysis are summarized in Table 11-1. We conclude that the Project for the port of Bitung is unquestionably feasible from an economic viewpoint.

Table 11-1 Results of the Sensitivity Analysis

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

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

Chapter 12 FINANCIAL ANALYSIS

Purpose of the Financial Analysis

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

Methodology of the Financial Analysis

2. The viability of the project is analyzed using the Discount Cash Flow Method and appraised by the FIRR(financial internal rate of return). Also the influence on the financial soundness of the port management body is appraised based on projected financial statements regarding the project.

Fund raising

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

(i) Foreign funds

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

(ii) Domestic funds

Fifteen percent of the construction costs for the project is assumed to be raised by domestic funds.

Analyzed pattern for FIRR appraisal

4. 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.

5. 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

6. 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)

7. 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

8. 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)

Sensitivity analysis

9. 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

10. The results are shown in Table 12-1. Also 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.

11. 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. On the other hand, regarding Case C and Case D, FIRR exceeds the average interest rate. Therfore 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

Financial soundness of the port management body

12. 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.

13. The financial indicators of both cases keep the preferable levels. 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.

14. 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.

Conclusion

15. 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. 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.

PART II

FEASIBILITY STUDY OF PORT OF KUPANG

Chapter 1 SOCIO-ECONOMIC PROFILE OF EAST NUSA TENGGARA

Geographical features and climate

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. Also 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.

Administrative division and demographic features

3. The administrative area of East Nusa Tenggara covers 12 Regencies, 98 Subdistricts and 97 Villages as shown in Figure 1-1.

4. 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.

Economic and industrial features

5. 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. On the other hand the industrial sector has grown very slowly as seen in its contribution of only 2% to GRDP.

6. 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.

7. 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.

8. 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.

Infrastructure

9. 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 length of road

network reach to about 14000 km. Also 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. In addition, there are 16 oil ports and fishery ports. In addition as for air transportation sector, there are 14 airports spread throughout this province and only the districts of Timor Tengah Selatan and Timor Tengah Utara are without an airport.

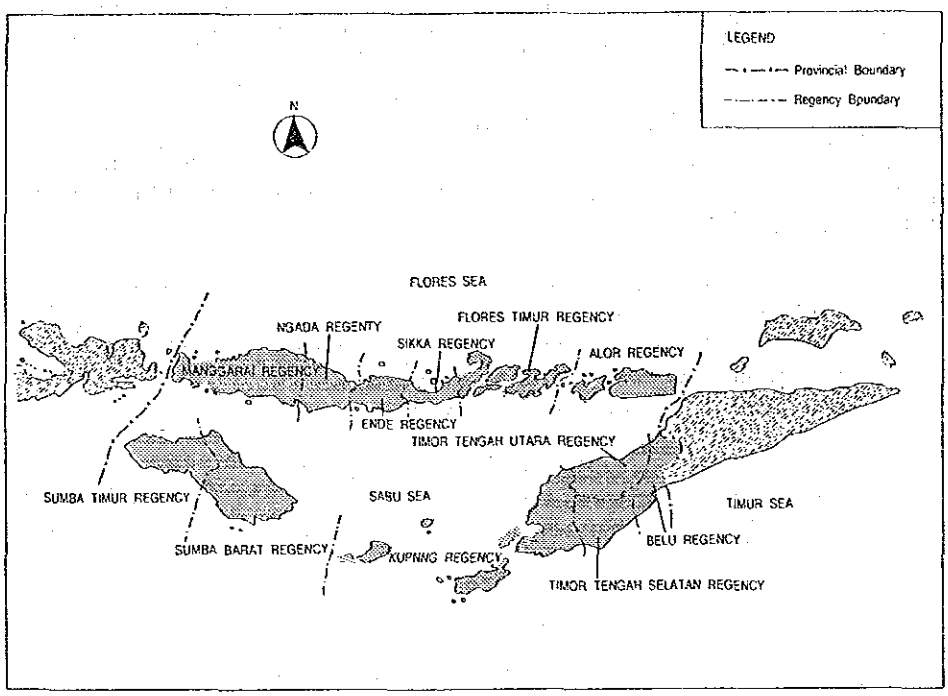


Figure 1-1 Administrative Division of East Nusa Tenggara

Table 1-1 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

Chapter 2 PRESENT SITUATION OF THE PORT OF KUPANG

Kupang regency

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. Also the climate in this area is tropical with high temperatures and high humidity.

Port related industries

2. 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, above all the major port related industries are Pertamina (Oil industry) and Cement industry.

Shipping routes

3. 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.

4. 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.

5. Kupang opened 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.

Port facilities

6. The berthing facilities at the port of Kupang are functionally classified as Interisland Wharf, Local Wharf and other berthing facilities. (refer to Figure 2-1)

7. 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.

8. 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.

9. 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

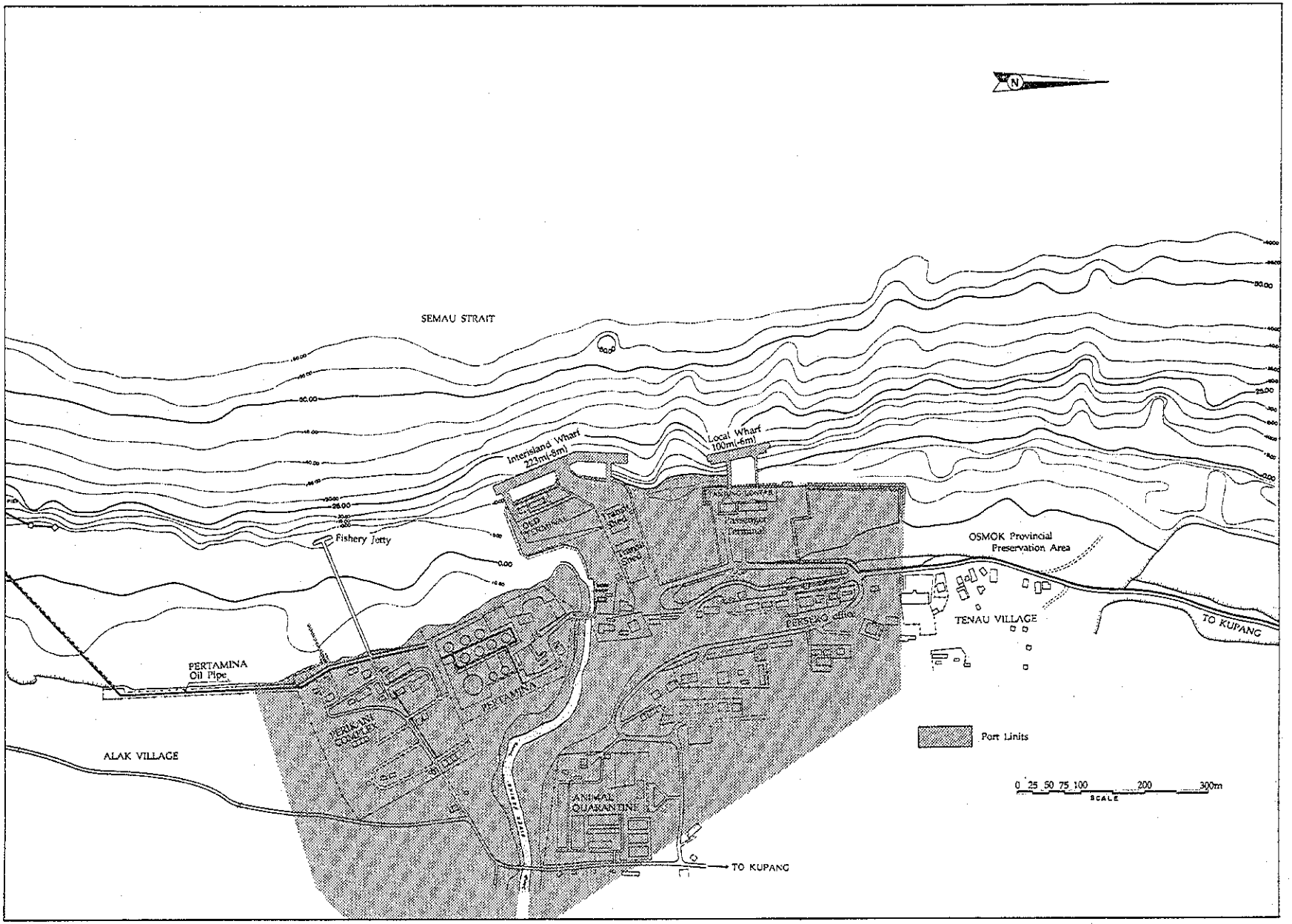


Figure 2-1 Existing Facilities of Kupang Port

km south of this port.

10. As for storage facilities, there are two transit sheds (1,500 m2, 1,000 m2) behind the interisland wharf. This port also has 4,950 m2 of asphalt paved open storage and 13,785 m2 of open storage which is paved with lime stone. Furthermore, this port already has a 1,265 m2 container yard which is paved with concrete blocks.

Cargo handling volume

11. 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. 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.

12. As for 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.

13. 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. 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.

14. As for 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.

Passenger traffic

15. The total passenger traffic increased steadily during 1984 - 1989. The average annual growth rate was more than 20% during the period. Number of passenger in 1989 was 66,037, which was the largest ever recorded at the port of Kupang. Since that year, number of passengers has been decreasing. A total of 53, 253 passengers embarked or disembarked at the port of Kupang in 1992.

Calling vessels

16. A total of 1,300 vessels including Pertamina special shipping called the port of Kupang in 1992. Gross Registered Tonnage of the calling vessels totaled 899,560 in 1992, which shows the annual growth rate of 9.83 % during 1984 - 1992. Also total of 1,171 ship calls, 638,438 GRT was recorded at the public wharves in 1992.

Facility utilization

17. In general, the utilization level of the berthing facilities is evaluated by Berth Occupancy Ratio (BOR) and Berth Throughput (BTP). According to the data of PERSERO III, there were fluctuations regarding the average BOR of all berthing facilities at this port from 1985 to 1992.
As for the historical development of indicator "BTP", there was an upward trend regarding the average BTP of all berthing facilities at this port.

Port management and operation

18. Public port facilities at Kupang port are managed by PERSERO branch office as class three commercial port. PERSERO office is responsible for maintenance and provisions of port facilities in good conditions, port services such as pilotage, towing, water supply, cargo handling as PBM, collection of port charge, preparation of port statistics and so on. ADPEL office, under KANWIL control, supervises the overall port operation as governmental coordinator.

Port labor and cargo handling

19. There are eight cargo handling companies including service division of PERSERO office itself in the port of Kupang. The number of registered port labors working at Kupang port is 350, and they are allocated to cargo handling companies on a daily basis by KOPERASI TKBM. Also cargo handling is operated approximately 350 days per year. Port labors usually work two shifts a day in the port of Kupang but the special cargo such as material for cement factory is unloaded all day long at three shift.

Financial statements of PERSERO III

20. As for financial statements of PERSERO III, operating ratio and working ratio has improved substantially. The value in 1991 (operating ratio: 59.4%, working ratio: 49.6%) shows the efficient financial conditions prevail at PERSERO III. As for the liquidity, the value of current ratio of PERSERO III has been at a very high level (above 300% in 1991) and it can furnish working capital easily to branch offices which run a deficit.

Review of the existing plans

21. The port development at Kupang port has been based on the master plan which was formulated by the foreign consultant named TTA. CONSULTANTS and Indonesian consultant named P.T. INCONEB in October 1985.

Chapter 3 NATURAL AND ENVIRONMENTAL CONDITIONS

A. Meteorological Conditions

Climate

1. Though Indonesia generally belongs to the tropical climate zone classified into tropical forest or tropical monsoon climate, Nusa Tenggara belongs to the semi-dry step climate zone extending from the northwest region of Australia. The climate there is divided into the rainy season from December to March and the dry season with little precipitation from May to October.

Temperature and humidity

2. Air temperature is slightly high in the rainy season and rather low in the dry season. Monthly mean temperature ranges from 25.6°C to 28.8°C with no substantial change throughout the year. Mean maximum temperature varies from 31°C to 33°C, and mean minimum temperature from 21°C to 24°C. The temperature fluctuation in a day is 7°C to 11°C. Relative humidity is rather high in the morning, around 85%, in the rainy season, and low humidity of less than 50% is occasionally recorded in the afternoon in the dry season. The mean relative humidity is within the range from 63% to 83%.

Precipitation

3. Annual mean precipitation is low, 1,443mm, and the fluctuation in annual total precipitation is remarkable. 85% of annual mean precipitation falls in the rainy season from December to March. Monthly mean precipitation ranges from 2mm in September to 388mm in January.

Wind

4. WNW wind prevails in the rainy season from November to April and ESE wind in the dry season from May to October. In the rainy season, wind velocity exceeds 10m/s with the superposition of sea breeze and monsoon in the afternoon.

Cloud cover

5. Cloud cover is 4 in the rainy season, but no more than 1 in the dry season, which indicates the areal coverage of clouds is below 10% in the whole sky. Therefore the weather is very clear.

B. Topographical Conditions

6. A mountain range with average elevation of 1,800 to 2,100m runs on Timor Island, and the highest is Mt. Fatamailau with elevation of 2,920m. Kupang Port (4°00' S and 119°30' E) is situated on the northern coast with no flatland but coral

and volcanic hills near the western edge of the island and wide fringing reefs are developed. In the old Kupang Port facing the north-west direction, extend fringing reefs with maximum width of about 500m and small ships cast their anchors at the edge of the reefs. The port is hardly usable during the NW wave season from December to April. Though located behind Semau Island in the west, Tenau Port or the new Kupang Port is affected at times by SW waves.

C. Bathymetric Conditions

7. The coastal profile is steel along the northern coast of Kupang Port. Coral reef, some 200m wide, spreads near the Pertamina Pier on the south coast. The seabed is little covered with coral fragments and lava sand.

D. Hydrographic/Oceanographic Conditions

Tide

8. Harmonic analysis of tide in Kupang Port reveals that the diurnal tide is prevailing with mixed tide. According to the tide observed during the period from August 6 to September 7, 1993, the HWL and LWL are fixed at +1.70m and ±0m, respectively.

Current

9. Current condition at Kupang Port is as follows.

(a) Maximum observed currents are 25 to 40cm/s. During spring tide, flood currents reach 3.4cm/s (357°) to 31.0cm/s (353°), though ebb currents reach 5.4cm/s (173°) to 8.7cm/s (177°).

(b) Currents oscillate in N-S direction. Prevalent currents flow centripetally to the port.

(c) Currents consist of semi and quadri-diurnal currents and short period turbulent currents.

(d) Northward flood and southward ebb currents flow fastest two hours before high and low tides, respectively.

Wave

10. Waves are predicted, based on the wind data in 1992 observed in Kupang, for they have never been observed in Kupang Port. Waves travel from WNW and NW and maximum significant wave is predicted as 0.93m and 3.9s.

Littoral drift

11. As sand and coral fragments are deposited on the seabed to some extent in and around Kupang Port, it is foreseeable that the littoral drifts occur due to the

wind wave and swell generated in the northwest monsoon season. However, it is expected that the influence of littoral drift on the port activities will be relatively reduced when the port facilities are expanded.

E. Geological Conditions

12. Quaternary volcanic rocks are widely spread over Timor Island, and Neogene sedimentary rocks and coral reefs are also spread.

F. Seismic Activity

13. Great folded mountains extending from the Himalayas in the direction of south to Sumatra, Jawa and Nusa Tenggara have volcanic chains where volcanic and seismic activities are notable. The folded mountains run through Flores Island, which was attacked and heavily damaged by earthquake and tsunami in December 1992, and Damar Island, and then turn to the west. Timor Island is situated on the other anticlinal axis, parallel to the said folded mountains, which runs from Sumba Island as its southwest edge to Maluku as its northwest edge, through Timor Island and Aru Island where the axis turns to the northwest.

G. Soil Conditions

14. Previous soil surveys were conducted in 1985 for extension of oil terminal in the direction of south and for construction of a new local pier. The boring surveys carried out for the present study aimed at verifying the seabed soil composition at a terminal point drawn from the previous boring point in the directions of north and south.

15. Seabed surface layer at the points on the lines parallel with the shoreline around the oil terminal is composed of medium hard sand mixed with gravel and coral fragments. Thickness of this surface layer of sand varies from 2m to 15m, inversely proportional to the water depth. A hard layer of limestone with N value of more than 50 underlies the surface layer, elevation of which is within the range of -22 to -28m.

16. Soil composition of the seabed north of the new local pier is generally similar to that of the seabed around the oil terminal, but a hard layer exists at the shallower elevation of -16m.

H. Environmental Conditions

17. Water quality surveys carried out in Kupang Port in August to September 1993 as a link of the environmental surveys. Sea water was sampled at the depth of 0.5m below the sea surface and at the depth equivalent to a half of the water depth at high tide and low tide during the spring tide. The surveys covered 8 physical and chemical items; water temperature (25 to 27°C), salinity (3.4 to 3.6%), pH (8.2 to 8.5), dissolved oxygen (4.5 to 7.2mg/l), transparency (water depth to 19m), COD (19 to 44mg/l), SS (12 to 22mg/l) and turbidity (5.0 to 6.5 NTU).

Chapter 4 DEVELOPMENT POTENTIAL OF THE PORT HINTERLAND

1. Kupang together with Darwin is expected to play roles as a logistic and supply base for materials, air transportation, and other logistic supports for offshore drilling in Area A of Timor Gap Project. A total of 45 wells will be drilled, with more than 20 exploration wells drilled in the first three years, amounting to a total exploration budget in excess of US$362 million. It is said that over the next few years, 20 international companies will explore the Timor Gap and the surrounding Timor Sea.

2. A public cement factory, PT. Semen Kupang, has an installed production capacity of 120,000 ton/year, and the factory is located on the hill about one km away from the port of Kupang. The cement factory has been proposing that its production capacity be increased up to 620,000 ton/year in order to meet the increasing demand of cement in the region.

3. There is another cement production project at Kupang. Memorandum of understanding has been exchanged between the Czech (formerly Czechoslovakia) government and the East Nusa Tenggara provincial government to establish a new cement factory with production capacity of 1,500,000 ton/year. The proposed site for the new cement factory is about 4 km south of the port of Kupang.

4. As shown in Figure 4-1, southern area of Kupang Port will be developed as an industrial zone, which will include 400 ha of land for the Timor Gap project-related industries. Road in the south of the port of Kupang is currently only 6 m wide, and will be improved to 18 m wide. Construction of a new road in the proposed industrial zone has been started.

5. Existing fishery jetty, which is adjacently located to the south of the port of Kupang, has been proposed to move further to the south. An area of 200 hectares of land near Bolok ferry terminal has been prepared for the relocation of the fishery jetty, village and school, and other fishery related facilities.

6. East Nusa Tenggara Province, unlike North Sulawesi Province, is a natural resource poor province, and the primary sector in the province has limited potential for development because of unfavorable soil and weather conditions. The provincial government places the highest priority for policy making on changing its economic structure. Timor Gap Project and Cement Industry Project represent opportunities to attain the above goal. These projects will induce regional industrial development, and fairly contribute to achieve the other policy objectives as well: poverty reduction and output increase.

7. To materialize the projects, construction of port facilities is a must because these projects will generate a considerable volume of new port traffic and require spacious open yards. It should be also noted that insufficient infrastructure in the province has been one of the main causes for poor performance of private investment, and that the government must take initiatives for development in this type of province.

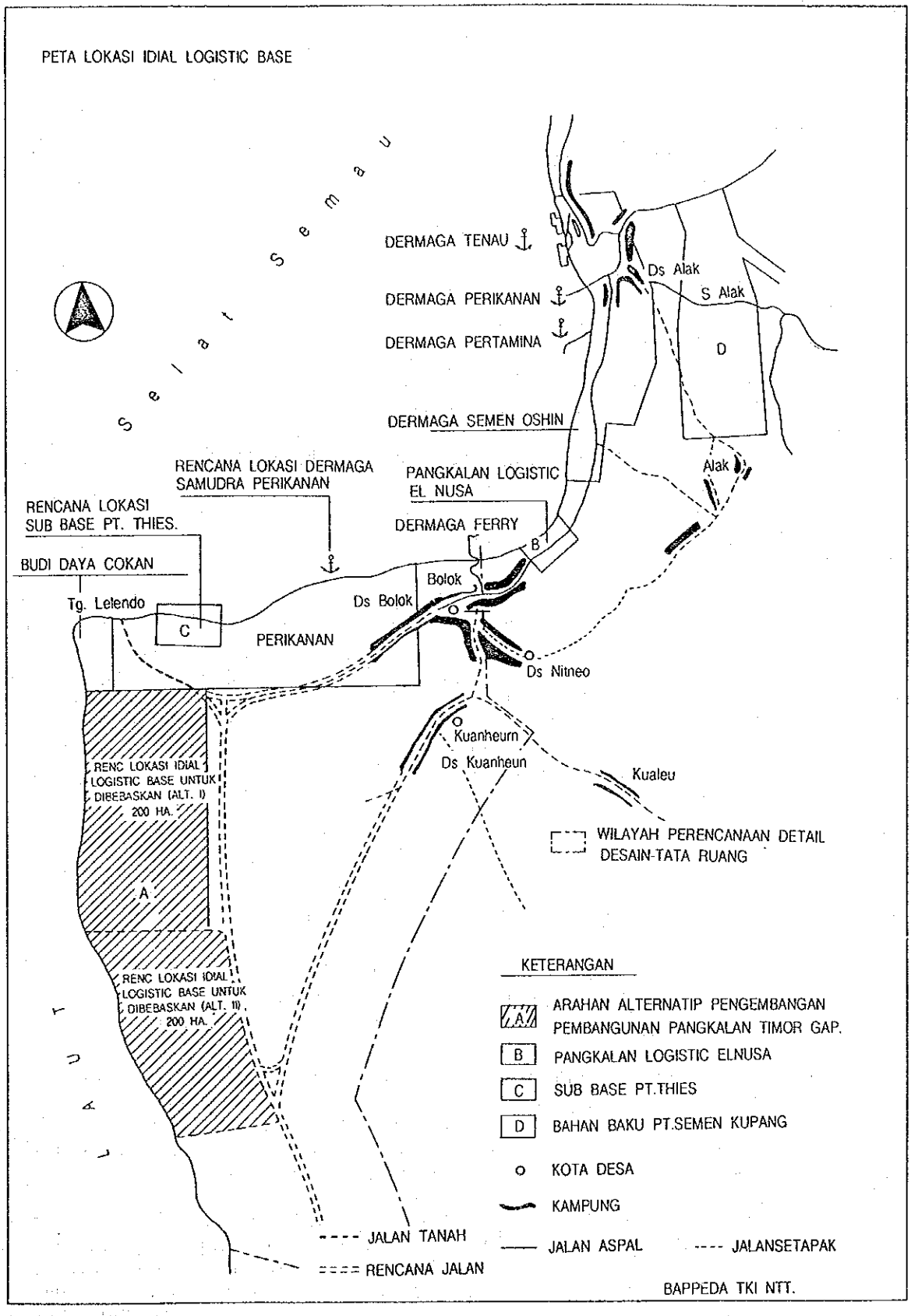


Figure 4-1 Proposed Land Use Plan

Chapter 5 TRAFFIC DEMAND FORECAST

General

1. Forecast of traffic through the port for the year of 2000 will be described in this Chapter. The traffic being forecasted in the present report is cargo volume only.

A. Socioeconomic Frame for the Target Year

Hinterland

2. When considering the island transport network, we may consider the following hinterlands for the port of Kupang.

Hinterland : West Timor, East Timor, Flores, Sumba and a number smaller islands in East Nusa Tenggara.

Population

3. The future population was estimated through a cooperative venture between the Demographic Institute of University of Indonesia and the National Development Planning Board. Indonesian Population will grow at an average growth rate of 1.87 percent. On the other hand, the projected growth rate of population of East Nusa Tenggara Province is 0.11 percent. This annual growth rate is lower than those in the other provinces. As a result, the total population of East Nusa Tenggara Province in 2000 is estimated to be about 3,306,000.

Economy

4. The economic growth rate is assumed at 7 % per annum in East Nusa Tenggara in this study so that the economic discrepancy between the national average and that of the province shall be decreased in future.

B. Methodology for Demand Forecast

5. Generally speaking, there are two methods to forecast the commercial cargo volume handled at the port. One is a macro forecast which is a method to estimate the cargo volume as a group including many commodities, regardless of the volume of each commodity. The other is a micro forecast, which is a method to estimate the cargo volume of each commodity individually.

6. Macro forecast follows the past trends without considering a special development plan. As discussed in Chapter 4, the port of Kupang is characterized as an industrial port, and cement production is expected to increase significantly. An industrial estate development project is also ongoing. Future cargo volume of a development port like Kupang cannot follow the past trends. Herein, the cargo

volumes handled at Kupang Port for the target year will be forecast as those obtained by the micro forecast method.

C. Forecast of Cargo Volume

7. Table 5-1 shows a summary of the forecast cargo. A total of 741,000 tons of cargo is expected to be loaded or unloaded at the port of Kupang in 2000.

Table 5-1 Result of Micro Forecast at Kupang Port

Unit : 1,000 ton

	Commodity	G. Cargo	Solid Bul	Bag cargo	Drum	Total
1	Rice	0	0	67	0	67
2	Foodstuffs	0	0	10	0	10
3	Fertilizer	0	0	6	0	6
4	Wood	0	17	0	0	17
5	Aspalt	0	0	0	22	22
6	Cement & Material	0	116	284	0	401
7	Genaral cargo	161	0	0	0	161
8	Material for Dev.	58	0	0	0	58
	Total	219	133	367	22	741

D. Volume of Container Cargoes

8. The volume of container cargo is forecast by multiplying containerizable cargo volume by the containerization rate. Containerizable cargo is estimated by an assessment of the physical characteristics of the major cargo categories and their suitability for containerization from the port statistic data. The containerization rate in target year is forecast based on the logistic curve method.

9. Volume of container cargo forecast is shown in Table 5-2. The volume of container cargo in target year can be obtained from the general cargo by the package type.

Table 5-2 Percentage of Containerization at Kupang Port

	1989	1990	1991	1992	2000
Container Cargo (ton)		86	940	1,006	21,908
Containerizable Cargo (ton)	71,996	78,173	75,515	96,780	210,081
Percentage of Containerization	0%	0%	1%	1%	10%

Chapter 6 PORT FACILITY DEVELOPMENT PLAN

A. Basic Consideration for the Port Development

1. Short term development plan for the port of Kupang in 2000 has been made. The following development policies are set;

(a) Government should initiate actions through improving port facilities at Kupang port to promote regional development in East Nusa Tenggara
(b) Kupang port should be developed to support locally-based industry
(c) Kupang port should be developed as a leading container port in the region
(d) Kupang port should be developed to support oil exploration projects in Timor Gap and Timor Sea

2. Based on the above development policies, the following planning framework is proposed;

(a) Berthing space for people's and local shipping should be expanded in the light of their significant roles
(b) Local Wharf should be expanded to accommodate a new passenger ship, which has about 140 m in length.

B. Present Capacity of the Port

Existing berth capacity

3. The optimum berth occupancy increases with the increase of number of interchangeable berths. The berthing facilities at the port of Kupang are basically divided into two categories: Interisland Wharf and Local Wharf. The Interisland Wharf consists of two or three berths, and the Local Wharf consists of more than three berths for sailing boats.

4. Considering the number of existing berths at the port, the optimum berth occupancy at each wharf can be estimated at 60 % for the Interisland Wharf and 65 % for the Local Wharf.

5. Analysis of ship call record and cargo handling documents of the port of Kupang for April 1993 reveals that ship productivity (BPI) of break-bulk cargo was 5.9 ton/ship-hour for Interisland Wharf, and 1.23 ton/ship-hour for Local Wharf provided that 50% of ship time at berth is spent for actual cargo handling. Main findings can be summarized as follows;

(a) Interisland Wharf

Number of Vessels	26	vessels
Ave. Ship Length	47.35	m
Ave. DWT	615.50	DWT/ship
Ave. Cargo Volume	378.01	ton/ship
Ave. Waiting Time	0.48	hr/ship
Ave. Berthing Time	64.19	hr/ship
Ave. Ship Productivity	5.89	ton/ship-hour

(b) Local Wharf

Number of Vessels	47	vessels
Ave. GRT	50.26	GRT/ship
Ave. Cargo Volume	75.90	ton/ship
Ave. Waiting Time	2.11	hr/ship
Ave. Berthing Time	123.90	hr/ship
Ave. Ship Productivity	0.61	ton/ship-hour

6. From the discussions above, the capacity of the existing berth can be estimated as follows:

1,248 ton/m x 223 m =	278,304 ton/year	for Interisland Wharf
336 ton/m x 100 m =	33,600 ton/year	for Local Wharf
Total	311,904	

Existing storage capacity

7. Based on the information provided by Kupang branch office of PERSERO III on the present practices at this port, standard capacity of the existing storage facilities is estimated at 150,000 tons/year for transit sheds and 900,000 tons/year for open storage areas.

8. According to the statistical data of Kupang branch office of PERSERO III, the container handling volume at this port in 1992 was about 240 TEUs. The port of Kupang has open space of 1,265 m2 for container storage, and its capacity is estimated at about 600 TEUs.

C. Required Scale of the Port Facilities

9. A total of 741,000 tons of cargo is forecast at the port of Kupang in 2000. Breaking down by packing type, general cargoes accounted for 219,000 tons, solid bulk 133,000 tons, bag cargo 367,000 tons, and drum 22,000 tons.

10. The existing Local Wharf accommodates PELNI passenger ship, which is 99.80 m in length. According to the branch office of PERSERO III, a new PELNI passenger ship with 144.8 m in length will call the port of Bitung. It is necessary for the port to expand the Local Wharf to accommodate the passenger ship safely. The required quay length for the new passenger ships is 170 m.

11. Local Wharf also accommodates Rakyat ships, which made a total of 705 shipcalls to Kupang in 1992. Role of the Rakyat shipping will remain important in the foreseeable future. It is recommendable that the government build a new jetty of 50 m in length for Rakyat ships.

12. Development of Rakyat Wharf and extension of Local Wharf are treated as on-gong projects in this study because engineering studies, which are necessary steps for the implementation of the projects, have been undertaken.

13. In order to accommodate the cement related traffic amounting to 401,000 tons in 2000, a new specialized berth should be built although part of the cement will be loaded at conventional berths.

14. A berth for heavy cargoes including containers should be built to help regional development and industrial development. This new berth will handle cargoes which are related to the industrial estate development project and oil exploration project.

15. Considering both the forecast cargo volume and the capacity of the existing berthing facilities, berth utilization in 2000 can be summarized as follows;

	Length (m)	Cargo ('000 ton)	BTP (ton/m)
Interisland Wharf	223	230 + cattle	1,100
Passenger/Local Wharf	170	43 + pass.+ Gov. ships	
Rakyat Berth	50	50	500
Cement Berth	130	344	2,646
Heavy Cargo Berth	130	74	570

Storage facility

16. The cement handling volume in 2000 is 284,000 tons in total. This port will require an area of about 1,700 m2 for the new transit shed at the new development area in 2000.

17. Container traffic at this port will be 3,800 TEUs in 2000, and the containers will be handled at the heavy cargo berth. The required area for container yard in 2000 is estimated at about 3,200 m2.

18. One of the necessary requirements as a supply base for oil exploration is to have sufficient area of open yard to stock materials and equipment. It is said that on average, one hectar per oil well is sufficient. At the new reclamation area, open spaces of about 1.4 ha can be used for the above activities.

Other facility

19. A 30 m-wide waterway which passes through the Cement Berth is also proposed to avoid flushing during the rainy season.

D. Access Roads

20. The southern area from the project site has a high potential for development, and construction works of infrastructures have been commenced. The existing conditions of the road between the port and the southern area are poor because of its steep and hilly geographical nature.

21. Development of an access road of 1,150 m in total length is proposed to smoothen vehicle traffic, especially container traffic, between the port and the industrial area. The new access road mostly runs along the waterfront.

E. Site Selection for the Port Development

22. It will be convenient for port operation and management if the location of the new port facilities is adjacent to the existing one. From the above viewpoint, the following two possible sites shall be evaluated as the site for port development: adjacently north of the existing Tenau port (Tenau North), and adjacently south of the existing Tenau port (Tenau South).

23. Tenau North has a locational advantage in being able to reduce cost and time of land transportation for the cargoes destined for downtown Kupang. On the other hand, the greatest disadvantage of this site lies in the environmental condition around this district. Coastal zone around this site has been designated as a natural conservation area. Therefore, this site is not suited as a location for port development.

24. Tenau South is an ideal site for port development from the viewpoint of natural conditions. Water basin is better shielded by Semau Island than the existing port site where high waves come about five days a year. Tenau South can be recommended as the site for the required port facilities.

F. Preparation of Alternative Layout Plans

25. In order to ensure the most adequate layout among various ideas within the constraints, following two alternatives were proposed:

Alternative 1: This alternative is based on an idea to avoid dredging works to get the required water depth alongside. Furthermore, the future expansion after 2000 is also kept in mind. The layout plan is shown in Figure 6-1.

Alternative 2: This alternative is based on an idea to build continuous berths for the benefits of easier berth utilization. Also, the future expansion after 2000 is considered.

G. Evaluation of Alternative Layout Plans

26. Alternative 1 has the following inherent advantages;

(1) To maintain the water depth, it is not necessary to dredge the sea bottom which consists of dead coral.
(2) Because there is no dredging, the impact to the water quality will be smaller during construction stage.
(3) By this reclamation, a larger port land area will be obtained.

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

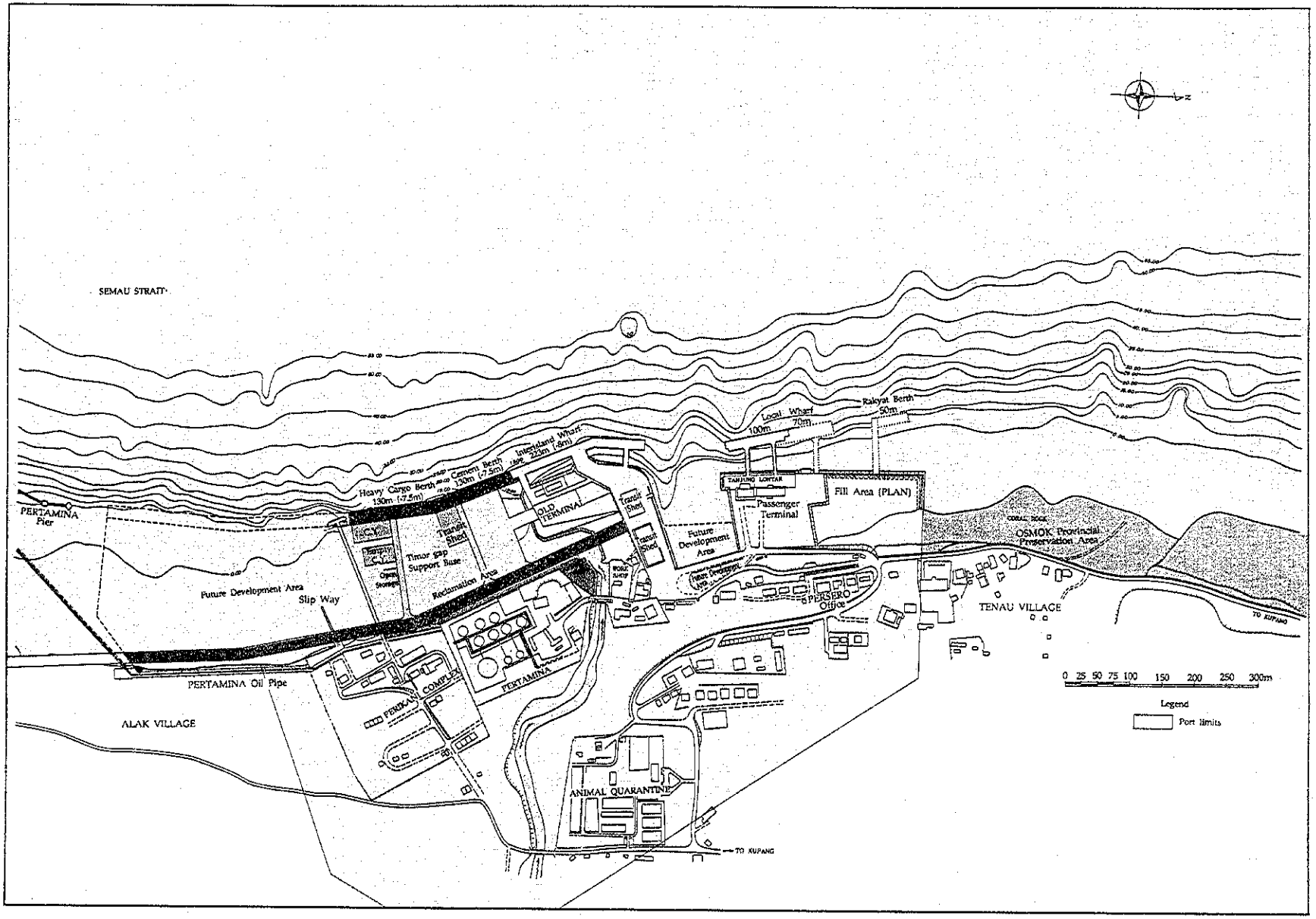


Figure 6-1 Kupang Port Development (Alternative 1)

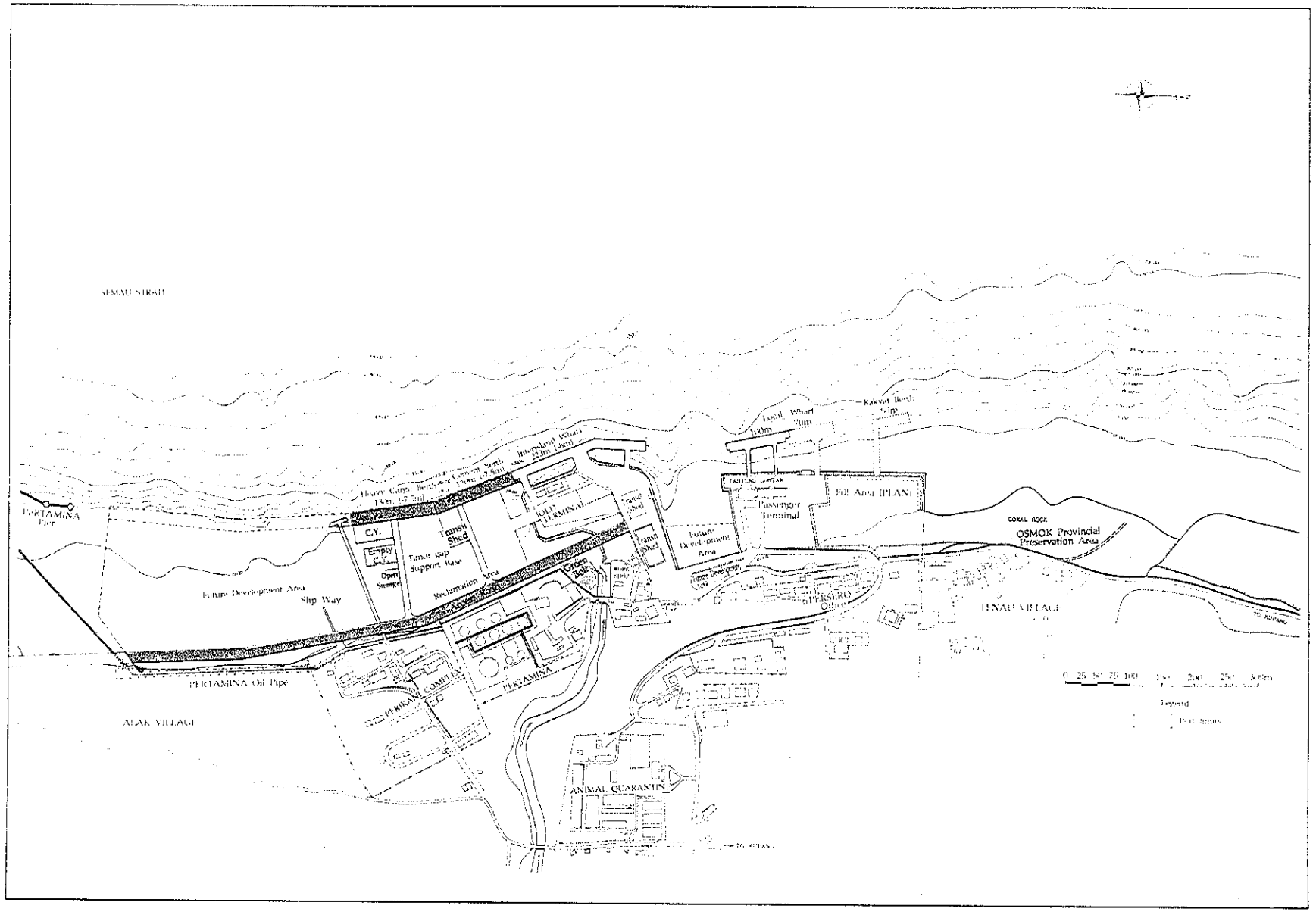


Figure 6-1 Kupang Port Development (Alternative 1)

H. Consideration of Degree of Calmness

28. The proposed berths will be used by medium-size vessels, which require wave height of less than 0.5 m as a condition for loading or unloading. Probability of occurrence of wave height of more than 0.5 m at these berths is less than 2%; 98% is workable.

I. Cargo Handling Equipment and Working Vessels

29. 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 Heavy Cargo Berth.

(a)	Heavy duty mobile crane (50t)	1 unit
(b)	Forklift trucks (24t)	1
(c)	Forklift trucks for vanning/devanning(2t)	1

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

(a)	Tug	(2 x 400 HP)	1 unit

J. Direction of further Development

31. The Port of Kupang has ample space for future development further south of the project site. The water area between the existing port facilities and the Pertamina jetty is crucial for the economic development of NTT, and thus should be preserved until time for port development is ripe.

Chapter 7 DESIGN OF THE MAJOR PORT STRUCTURE

A. Basic Design Principles and Facilities to be Designed

1. The new port structure is proposed to consist of a cement handling wharf and a heavy cargo wharf to handle plant, equipment and materials for accelerating the industrialization in the region.

2. Kupang area is within the Seismic Zone II where an earthquake of large magnitude takes place frequently. Seabed in the port area is composed of thick loose sandy layers. Accordingly, the proposed port structure should be of an earthquake-resistant type.

3. Locally produced materials should be used in the construction works to the maximum extent, and precast members manufactured on land should be used to minimize the offshore works.

4. The proposed major facilities for the Kupang Port are as follows:

Cement Berth:	*Berth, transit shed, revetment and access road.*
Heavy Cargo Berth:	Berth, container yard, open storage, revetment and access road.

B. Design Conditions and Structural Type

5. Tide level at Kupang port is +1.70m at time of high water and ±0.00m at time of low water. Required water depth alongside the both cement and heavy cargo berths is taken as -7.5m, and the required berth elevation of +3.50m is taken in accordance with the Design Criteria of DGSC.

6. Existing water depth at the proposed construction site of the berths varies from 8m to 18m. In general, seabed at the construction sites is composed of upper layer of loose sand and lower layer of hard limestone which lies at the elevation of -22 *m to* -27*m*.

7. Governing design loads include surcharge, earthquake factor and wheel load of cargo handling equipment. The surcharge on the berths is taken as 3 tons/m^2, and the earthquake factor of 0.15g is adopted in consideration of some additional factors to the regional earthquake factor of 0.09g. The design wheel load is determined based upon the maximum wheel load of the cargo handling equipment to be used on each berth.

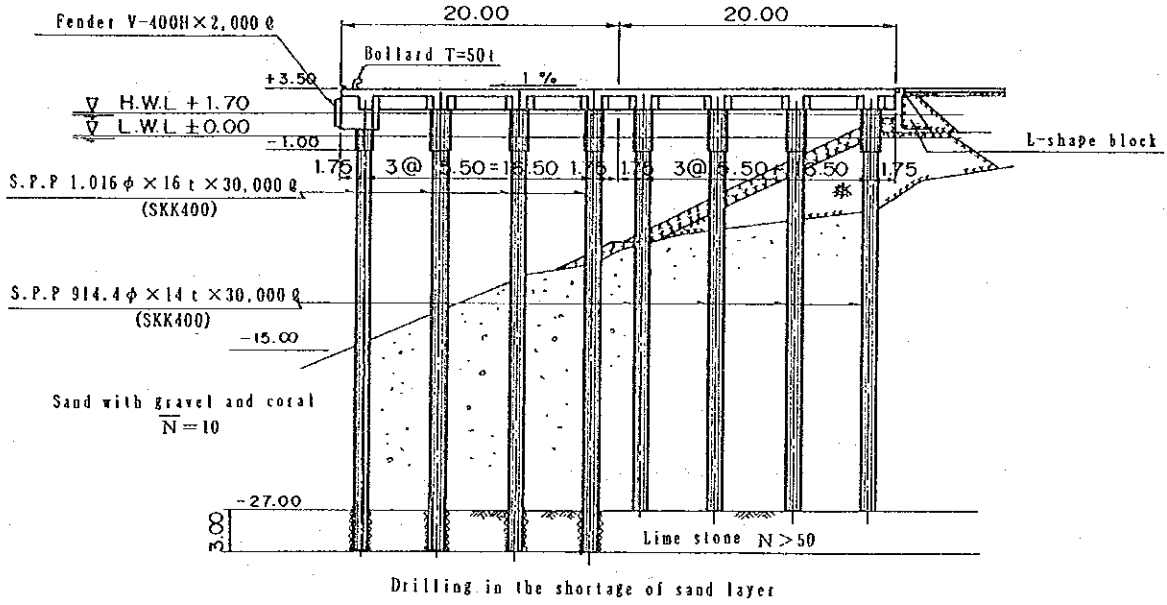
8. Pier type structure with steel pipe pile foundations is selected for the both cement and heavy cargo berths in consideration of the existing water depth at the sites which is larger than the required depth and also of the necessity of pile driving into the hard limestone layer to secure the sufficient load bearing capacity. Standard cross section of the berths is illustrated in Figure 7-1.

9. The existing river is planned to be renovated into an open channel of 30m wide, and a PC girder bridge of 20m span is planned to allow the access road to

cross the river.

10. Container yard of the heavy cargo berth is so designed as to allow the stacking of stuffed container in 3 tiers.

(1) Cement Berth



(2) Heavy Cargo Berth

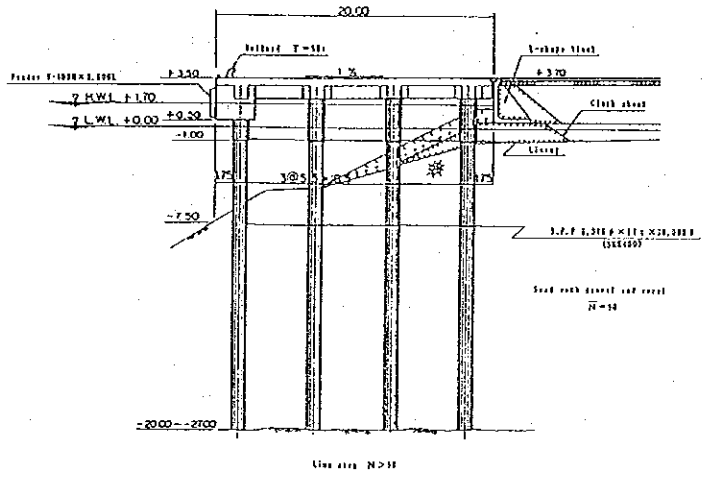


Figure 7-1 Standard Cross Section

Chapter 8 COST ESTIMATE AND CONSTRUCTION SCHEDULE

A. Basic Conditions for Cost Estimation and Construction Cost

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. Accordingly, the basic unit prices are as of May 1993.

2. The Construction Cost id divided into the local currency portion and the foreign currency portion. The applicable currency exchange rates are taken as follows:

US$1.00 = Rp.2,083 = ¥105.47 (¥1 = Rp.19.75)

3. 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 cost of civil and building works, procurement cost of equipment and craft, and engineering and supervision fee.

4. For the engineering and supervision fee, ten percent (10%) of the direct cost of 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.

5. 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, procurement cost of equipment and craft, engineering and supervision fee, and physical contingency.

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

7. Results of the cost estimation are shown in Table 8-1. From the Table the following is known:

Cement Berth : Rp. 21,451 million

Heavy Cargo Berth :Rp. 18,346 million

B. Construction Schedule

8. The planned construction sites in the Kupang Port is extremely calm during the dry season. During the rainy season, however, construction works may be greatly hampered by waves, swells and winds. Piling work, a key component of the construction works, should be executed when the sea is calm.

According to the estimated construction schedule, it takes two (2) years each to complete the construction of cement berth and heavy cargo berth.

9. Figure 8-1 shows the construction schedule of the cement and heavy cargo berths, respectively. 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.

Table 8-1 Construction Cost

(1) Cement Berth

Construction Item	Works	Quantity	Unit	Total Cost	Total LC	Total FC
I. Direct Cost				15,136.1	14,724.8	411.3
1-1. Mobilization and Preparation		1	L	675.0	675.0	-
1-2. Reclamation	Revetment	240	m	971.9	971.9	-
	Reclamation	64,000	m^3	458.2	458.2	-
1-3. Cement Berth	Main Pier	2,600	m^2	6,838.4	6,838.4	-
	Trestle Pier	510	m^2	465.1	465.1	-
	Yard	3,000	m^2	303.1	303.1	-
	Miscellaneous	1	L	1,832.5	1,421.2	411.3
	Road	450	m	3,591.9	3,591.9	-
II. Craft		1	L	1,145.5	1,145.5	-
III. Engineering and Supervision		1	L	1,513.6	454.0	1,059.6
IV. Physical Contingency		1	L	1,706.0	1,632.4	73.5
V. VAT		1	L	1,950.2	1,950.2	-
Grand Total				21,451.4	19,906.9	1,544.4

(2) Heavy Cargo Berth

Construction Item	Works	Quantity	Unit	Total Cost	Total LC	Total FC
I. Direct Cost				10,848.1	10,436.8	411.3
1-1. Mobilization and Preparation		1	L	675.0	675.0	-
1-2. Reclamation	Revetment	145	m	290.5	290.5	-
	Reclamation	96,000	m^3	687.4	687.4	-
1-3. Heavy Cargo Berth	Main Pier	2,600	m^2	5,091.7	5,091.7	-
	Container Yard	5,000	m^2	479.6	479.6	-
	Miscellaneous	1	L	1,603.5	1,192.2	411.3
	Road	450	m	2,020.4	2,020.4	-
II. Equipment and Craft		1	L	3,372.7	1,384.1	1,988.6
III. Engineering and Supervision		1	L	1,084.8	325.5	759.3
IV. Physical Contingency		1	L	1,372.7	1,214.7	158.0
V. VAT		1	L	1,667.9	1,667.9	-
Grand Total				18,346.2	15,029.0	3,317.2

(1) Cement Berth

Construction Item	Works	Quantity	Unit	Mar 1997	Mar 1998	Mar 1999	Mar 2000
				1st year	2nd year	3rd year	
1. Mobilization & Preparation		1	L				
2. Reclamation	Revetment	240	m		7.5M 1.3m/d		
	Reclamation	64,000	m^3		8.5M 310m^3/d		
3. Cement Berth	Main Pier	2,600	m^2		7M 15m^2/d		
	Trestle Pier	510	m^2		3M		
	Yard	3,000	m^2			2M 100m^2/d	
	Miscel-laneous	1	L			12M	
	Road	700	m			12M	
4. Craft		1	L			Build	Site
5. Engineering & Supervision		1	L	Engineering		Supervision	

Note: 1 Month (1M) = 25 days
: 1 Year = 300 days

(2) Heavy Cargo Berth

Construction Item	Works	Quantity	Unit	Mar 1997	Mar 1998	Mar 1999	Mar 2000
				1st year	2nd year	3rd year	
1. Mobilization & Preparation		1	L				
2. Reclamation	Revetment	145	m		4.5M 1.3m/d		
	Reclamation	96,000	m^3		12M 310m^3/d		
3. Heavy Cargo Berth	Main Pier	2,600	m^2		7M 15m^2/d		
	Container Yard	5,000	m^2			2M 100m^2/d	
	Miscel-laneous	1	L			12M	
	Road	450	m			12M	
5. Equipment & Craft		1	L			Build	Site
6. Engineering & Supervision		1	L	Engineering		Supevision	

Note: 1 Month (1M) = 25 days

Figure 8-1 Construction Schedule

Chapter 9 ENVIRONMENTAL IMPACT ASSESSMENT

A. Basic Procedure of Environmental Impact Assessment

1. Environmental Impact Assessment (EIA) concerning the port development of Kupang 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. 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.

5. In this study, the target of environmental preservation was established as follows;

"The impact to environment will be permissibly small."

B. Impact Assessment of Construction Works

Water quality

6. A major indicator of water pollution caused by construction works is Suspended Solid (SS). In this case, the scale of construction works is not so large. Therefore, the volume of SS is limited. Furthermore, it is efficient for cutting the increase of SS to start the reclamation work after the shore protection is completed. Thus it seems that the impact to water quality around Kupang port during the construction period will be permissibly small.

Other environmental components

7. In this study, other environmental components (Air quality, Noise, Vibration, Odor, Fauna, Flora, Wastes, Socio-culture and Socio-economy) were also assessed based on the conditions of construction works at this port. It seems that the impact to all other environmental components will be permissibly small.

C. Impact Assessment of Existence of Port

Coastal hydrology

8. In general, it is thought that tidal current is affected by existence of reclamation areas and breakwaters. In this case, the new reclamation area for the cement berth and the heavy cargo berth is planned, so, it seems that the impact to tidal current will occur. In this study, computer simulation technique was applied.

9. "A depth averaged two dimensional hydrodynamic model" was applied. The result of simulation is shown in Figure 9-1. According to the result, 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.

Other environmental components

10. In this study, other environmental components (Water quality, Topography, Fauna, Flora, Scenic view, Socio-culture and Socio-economy) were also assessed based on the present conditions and the port development plan of this port. It seems that the impact to all other environmental components will be permissibly small.

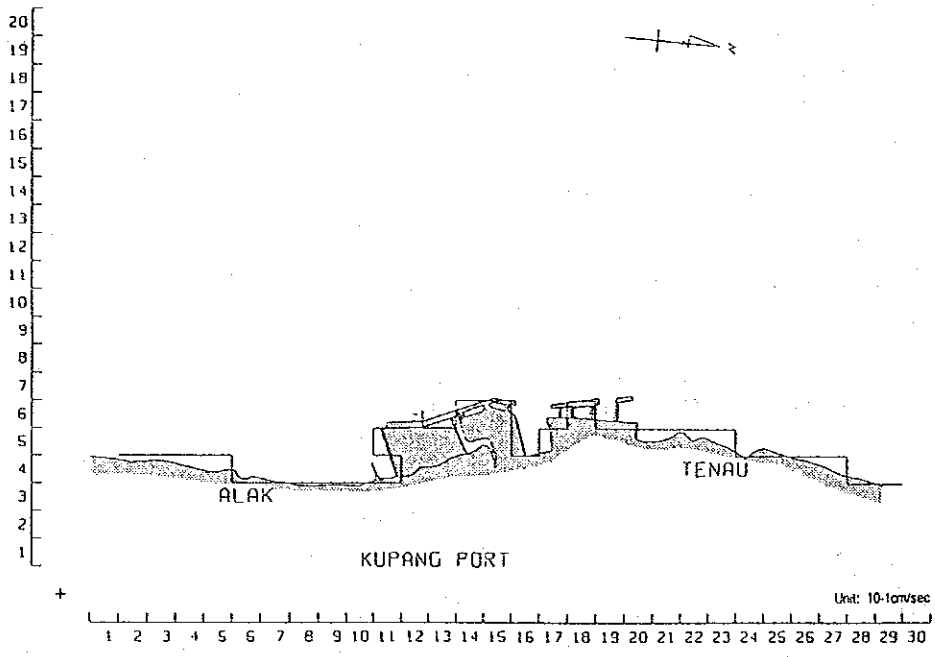


Figure 9-1 Tidal Current Velocity Difference [Case (Future-Present)]

D. Impact Assessment of Utilization of Port Facilities

Water quality

11. 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. In this study, computer simulation technique was applied.

12. "A depth averaged two dimensional diffusion model for passive materials" was applied. The result of the simulation is shown in Figure 9-2. According to the result, transition area of water quality will be limited and transition of concentration of COD will be maximum 0.1 mg/l. So it seems that the impact to water quality will be small.

Other environmental components

13. In this study, other environmental components (Air quality, Bottom conditions, Noise, Vibration, Odor, Topography, Fauna, Flora, Wastes, Socio-culture and Socio-economy) were also assessed based on the present conditions and the port development plan of this port. It seems that the impact to all other environmental components will be permissibly small.

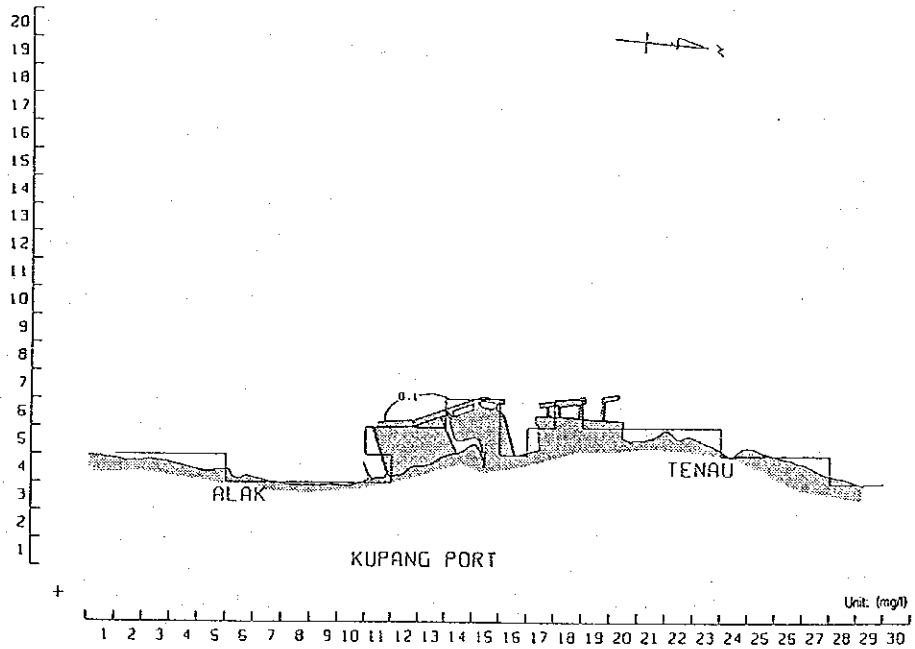


Figure 9-2 COD Concentration Difference [(Future-Present)]

E. Countermeasures for Environmental Preservation

14. According to the results of environmental impact assessment regarding the port development at Kupang port, countermeasures for environmental preservation are required to maintain the target of environmental preservation.

15. One of the most important countermeasures is as follows;

"After the shore protection is completed, the reclamation works should be started"

Chapter 10 PORT MANAGEMENT AND OPERATION

1. To promote port use, it is essential to provide attractive port services to port users. From this viewpoint, we have examined problems in the port management and operations and made some recommendations.

Introduction of flexibility in gang formation and allocation of port labor

2. The current gang size for cargo handling consists of a total of 48 persons, and this gang formation is fixed regardless of the kinds of commodity and packing type of cargo. However 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. Also port laborers are allocated only on a daily basis, therefore different laborers may handle the cargo of the same vessel when it take several days to load or unload the cargo of one vessel. In addition, wage for port labor is fixed on a daily basis irrespective of cargo handling productivity. To give incentives for efficient cargo handling of port labor, allocation of port labor on vessel basis and pace rate wage according to productivity should be introduced.

Adequate coordination with land transport by truck

3. In the port of Kupang, about 50% of cargo is directly delivered to consignees in the hinterland by trucks. However, in this direct delivery operation, sometimes there is inadequate coordination with land transport. Adequate coordination with land transport should be promoted through compulsory participation of forwarder in P2T meeting.

Maintaining the cargo handling equipment in good condition

4. To cope with mechanization of cargo handling from now on, maintenance staff should be so trained and skilled as to inspect regularly and repair light breakdown. Also It is necessary to stock the spare parts which are used often. In addition, the present budgets allocated for maintenance is too small to maintain this equipment in good condition. More funds should be allocated for maintenance.

Training and improvement of working conditions for port labors

5. To adapt port laborers to the 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. Also for a port to function smoothly, skilled and stable port labor is necessayy. For that purpose it will be important to offer good quality working conditions to port labor as well as adequate port labor training.

Specialization of cargo handling at the Cement Berth

6. Large quantity of special cargo such as cement is effectively and preferably handled exclusively at a specialized wharf. It will produce efficient and reliable cargo handling, storage and delivery. From this view point, if necessary, PERSERO office should admit for user to equip with specialized handling machine.

Chapter 11 ECONOMIC ANALYSIS

A. Purpose and Methodology of Economic Analysis

Project

1. The project in this study is defined as development of Cement Berth and Heavy Cargo 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.

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.

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. In the cost-benefit analysis, 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.

"With & Without" case

7. 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.

C. Economic Prices

Economic prices of benefit item

8. 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.

Project costs

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

10. In the economic analysis, construction 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).

11. Since the maintenance costs, replacement costs and residual values include various indefinite elements, they are converted into economic prices by multiplying the SCF.

D. Evaluation

12. 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.

13. The base EIRR and the sensitivity analysis are summarized in Table 11-1. We conclude that the Project for the port of Kupang is unquestionably feasible from an economic viewpoint.

Table 11-1 Results of the Sensitivity Analysis

	Original Case	Case (a)	Case (b)	Case (c)
EIRR (%)	15.3	13.6	13.4	11.9

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

Chapter 12 FINANCIAL ANALYSIS

Purpose of the Financial Analysis

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. Also the project in this study is defined as development of Cement Berth and Heavy Cargo Berth.

Methodology of the Financial Analysis

2. The viability of the project is analyzed using the Discount Cash Flow Method and appraised by the FIRR (financial internal rate of return). Also the influence on the financial soundness of the port management body is appraised based on projected financial statements regarding the project.

Fund raising

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

(i) Foreign funds

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

2) Domestic funds

Fifteen percent of the construction costs for the project is assumed to be raised by domestic funds.

Analyzed pattern for FIRR appraisal

4. 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.

5. Case A

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

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

6. Case B

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

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

7. Case C

PERSERO III will be resposible 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 III 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 III internal funds

8. Case D

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

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

Sensitivity analysis

9. 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

10. The results are shown in Table 12-1. Also 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.

11. Regarding Case A, Case B and Case C, result of sensitivity analysis falls below a financially feasible level. On the other hand, regarding Case D in which initial investment is the resposibility of the government, FIRR exceeds the average interest rate. Therefore as a result of sensitivity analysis, Case D is considered to be financially feasible.

Table 12-1 Result of Calculation of FIRR (Port of Kupang)

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

	FIRR	Remarks
Original	-2.3%	
Sensitivity Analysis(1)	-3.5%	Revenue 10%Down
Sensitivity Analysis(2)	-3.4%	Cost 10%Up
Sensitivity Analysis(3)	-4.6%	Revenue 10%Down, Cost 10%Up

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

	FIRR	Remarks
Original	0.9%	
Sensitivity Analysis(1)	-0.1%	Revenue 10%Down
Sensitivity Analysis(2)	0.0%	Cost 10%Up
Sensitivity Analysis(3)	-1.0%	Revenue 10%Down, Cost 10%Up

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

	FIRR	Remarks
Original	3.6%	
Sensitivity Analysis(1)	2.6%	Revenue 10%Down
Sensitivity Analysis(2)	2.7%	Cost 10%Up
Sensitivity Analysis(3)	1.6%	Revenue 10%Down, Cost 10%Up

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

	FIRR	Remarks
Original	5.9%	
Sensitivity Analysis(1)	4.9%	Revenue 10%Down
Sensitivity Analysis(2)	5.0%	Cost 10%Up
Sensitivity Analysis(3)	4.0%	Revenue 10%Down, Cost 10%Up

Financial soundness of the port management body

12. Case D which is judged to be feasible by FIRR analysis, is appraised from the viewpoint of financial soundness of the implementation body.

13. The financial indicators of the this case almost keep the preferable levels. Also regarding profit and loss statement, it takes 4 years after starting operation to clear deficit per year and takes 10 years to clear cumulative deficit, which can be judged as feasible.

Conclusion

14. 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. 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.