

社会開発調査部報告書

COOPERATION AGENCY (ICCA)

NO. 23

DIRECTORATE GENERAL OF SEA COMMUNICATION
MINISTRY OF COMMUNICATIONS
THE REPUBLIC OF INDONESIA

THE STUDY ON INTEGRATED MODERNIZATION PLAN FOR SEA TRANSPORTATION IN EASTERN INDONESIA

FINAL REPORT

SUMMARY & FEASIBILITY STUDY



MARCH 1984

THE OVERSEAS COASTAL AREA DEVELOPMENT INSTITUTE OF JAPAN (OCAI)
JAPAN PORT CONSULTANTS LTD. (JPCO)

5-51E
JPCO
87-050

JICA LIBRARY



1120458131

27955

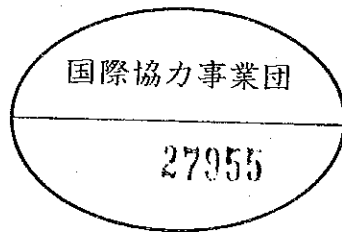
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DIRECTORATE GENERAL OF SEA COMMUNICATION
MINISTRY OF COMMUNICATIONS
THE REPUBLIC OF INDONESIA

**THE STUDY ON INTEGRATED MORDERNIZATION PLAN
FOR SEA TRANSPORTATION
IN EASTERN INDONESIA**

FINAL REPORT

SUMMARY 2. FEASIBILITY STUDY

MARCH 1994



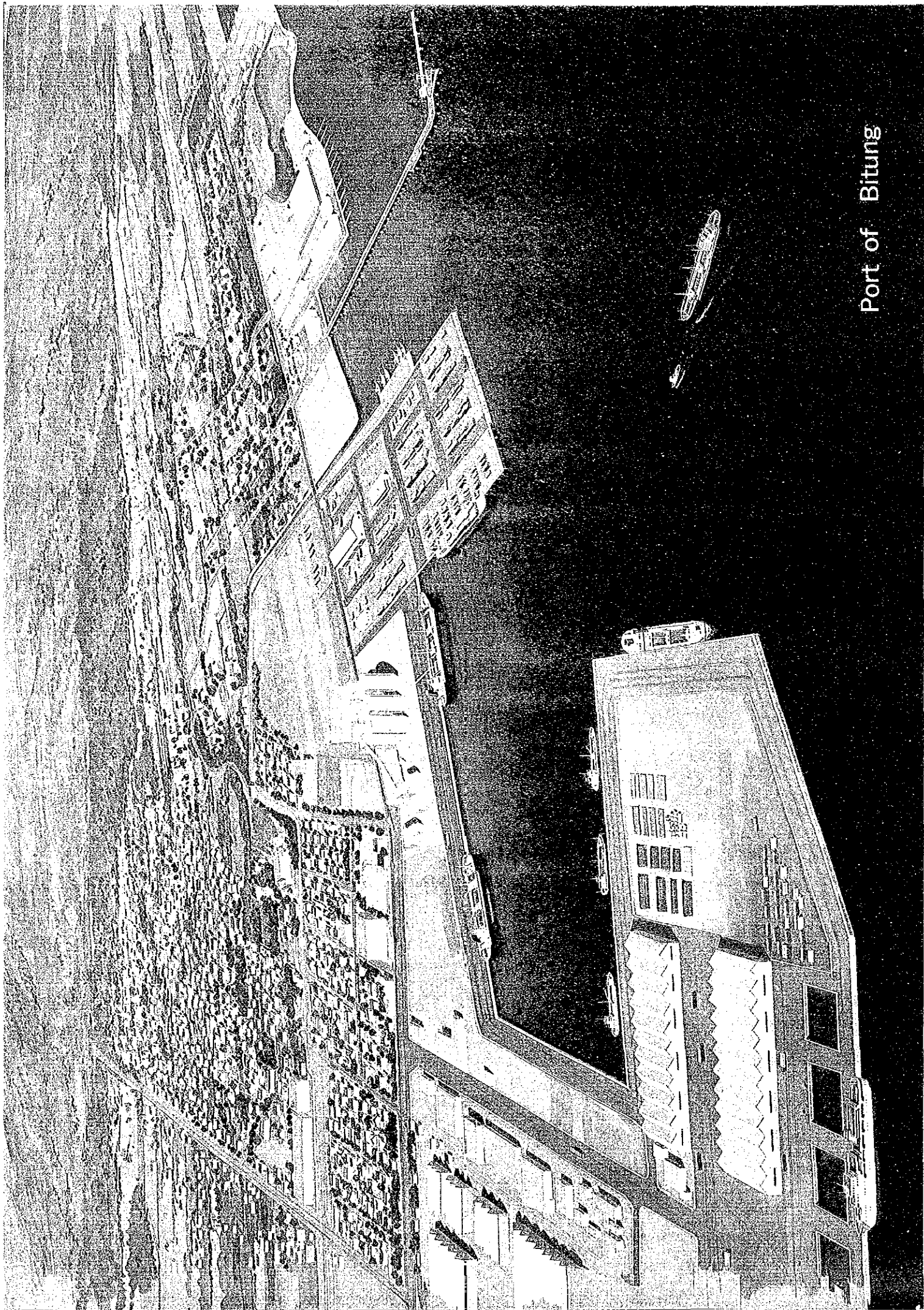
EXCHANGE RATE

US\$1.00 = Rp. 2,083 = ¥ 105.47

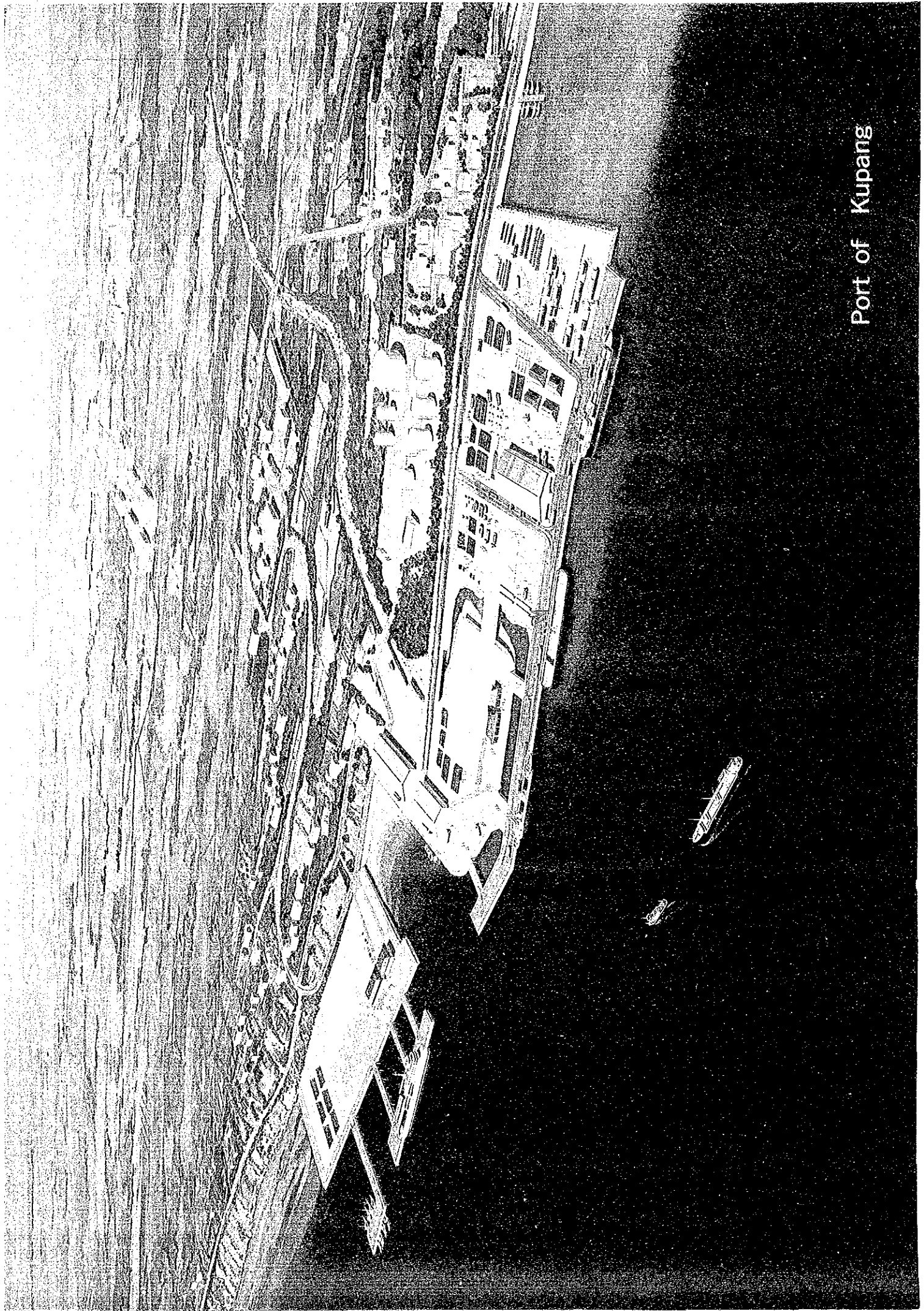
(June 1993)



Feasibility Study Ports



Port of Bitung



Port of Kupang

ABBREVIATIONS LIST

A	ADB	Asian Development Bank
	ADPEL	Port Administrator
	AFTA	Asian Free Trade Agreement
	ASEAN	Association of South-East Asian Nations
	Av.	Average
B	BAPPEDA	Provincial Development and Planning Board
	BAPPENAS	National Development Planning Agency
	BIRO	Bureau
	BOD	Biochemical Oxygen Demand
	BOR	Berth Occupancy Rate
	BPI	Berth Performance Index
	BPS	Central Bureau of Statistics
	BTP	Berth Throughput
C	CFC	Conversion Factor for Consumption
	CFS	Container Freight Station
	CIF	Cost, Insurance and Freight
	CO	Carbon Monoxide
	COD	Chemical Oxygen Demand
	C.Y.	Container Yard
	D	dB
DIP		Decided Project Table of the Government Budget
D.G.L.T		Directorate General of Land Transportation
D.G.S.C.		Directorate General of Sea Communication
DO		Dissolved Oxygen
D.W.T.		Dead Weight Tonnage
E	EIA	Environmental Impact Assessment
	EIRR	Economic Internal Rate of Returns
	E.N.T.	East Nusa Tenggara

F	FC	Foreign Currency
	FCL	Full Container Load Cargo
	FIRR	Financial Internal Rate of Returns
	FOB	Free on Board
G	G.C.	General Cargo
	GDP	Gross Domestic Product
	GOI	Government of Indonesia
	GPI	Gang Productivity Index
	GRDP	Gross Regional Domestic Product
	GRT	Gross Registered Tonnage
	GT	Gross Tonnage
H	HA	Hectare(s)
	HP	Horse Power
	HR	Hour(s)
	HWL	High Water Level
I	IBRD	International Bank for Reconstruction and Development
	ILS	Inter-Island Liner System
	ISTS	Integrated Sea Transport Study
J	JICA	Japan International Cooperation Agency
K	KANPEL	Governmental Office at Non-commercial Port
	KANWIL	Provincial Office
	KG	Kilogram
	KLH	Ministry of State for Population and Environment
	KM	Decree of the Minister
	Km	Kilometer(s)
	KHUSUS	Special Sipping
	KOPERASI TKBM	Port Labour Corporation
L	LC	Local Currency
	LCL	Less than Container Load Cargo
	LWL	Low Water Level
	LPG	Liquefied Petroleum Gas

M	M	Meter(s)
	MARPOL	Final Act of the International on Marine Pollution
	MIN	Minute(s)
	MOC	Ministry of Communications
	MOF	Ministry of Finance
N	NO ₂	Nitrogen Dioxide
	NO _x	Nitrogen Oxides
	NTT	Nusa Tenggara Timor
O	OCC	Opportunity Cost of Capital
	OD	Origin and Destination
	OSOR	Open Storage Occupancy Ratio
	OSTP	Open Storage Throughput
P	PAKNOV 21/88	Regulation Reform Package in 1988
	PAO	Port Administrator's Office
	PC	Prestressed Concrete
	PELNI	State-owned Shipping Company
	PERSERO	State-owned Company
	PERTAMINA	State-owned Oil Company
	PERUM ASDP	State-owned Ferry Terminal Company
	PERUMPEL	Port State Enterprise
	PERINITS	Pioneer Ship System to Serve Remote Areas
	pH	Potential of Hydrogen
	PPI	Port Performance Index
	P.T.	Limited Company
	P2T	Center of Port Service
	P4T	Integrated Control and Service Planning Center
R	REPELITA	Five Year National Development Plan
	RLS	Regular Liner Service
	RP.	Rupiah
S	SCF	Standard Conversion Factor
	SOR	Shed Occupancy Ratio
	SO ₂	Sulphur Dioxide

	SOx	Sulphur Oxides
	SPM	Suspended Particulate Matter
	SS	Suspended Solid
	STP	Shed Throughput
T	TEU	Twenty Foot Equivalent Unit
U	UNCTAD	United Nations Conference on Trade and Development
V	VAT	Value Added Tax
\$		Dollar
¥		Japanese Yen

CONTENTS OF EXECUTIVE SUMMARY (2)

ABBREVIATIONS LIST CONCLUSIONS AND RECOMMENDATIONS

PART I FEASIBILITY STUDY OF PORT OF BITUNG

Chapter 1	SOCIO-ECONOMIC PROFILE OF NORTH SULAWESI PROVINCE..	1
Chapter 2	PRESENT SITUATION OF THE PORT OF BITUNG	3
Chapter 3	NATURAL AND ENVIRONMENTAL CONDITIONS.....	7
Chapter 4	DEVELOPMENT POTENTIAL OF THE PORT HINTERLAND	10
Chapter 5	TRAFFIC DEMAND FORECAST.....	12
Chapter 6	PORT FACILITY DEVELOPMENT PLAN.....	14
Chapter 7	DESIGN OF THE MAJOR PORT STRUCTURE.....	20
Chapter 8	COST ESTIMATE AND CONSTRUCTION SCHEDULE.....	22
Chapter 9	ENVIRONMENTAL IMPACT ASSESSMENT.....	25
Chapter 10	PORT MANAGEMENT AND OPERATIONS	28
Chapter 11	ECONOMIC ANALYSIS.....	29
Chapter 12	FINANCIAL ANALYSIS.....	31

PART II FEASIBILITY STUDY OF PORT OF KUPANG

Chapter 1	SOCIO-ECONOMIC PROFILE OF NORTH SULAWESI PROVINCE..	35
Chapter 2	PRESENT SITUATION OF THE PORT OF BITUNG	37
Chapter 3	NATURAL AND ENVIRONMENTAL CONDITIONS.....	41
Chapter 4	DEVELOPMENT POTENTIAL OF THE PORT HINTERLAND	44
Chapter 5	TRAFFIC DEMAND FORECAST.....	46
Chapter 6	PORT FACILITY DEVELOPMENT PLAN.....	48
Chapter 7	DESIGN OF THE MAJOR PORT STRUCTURE.....	54
Chapter 8	COST ESTIMATE AND CONSTRUCTION SCHEDULE.....	56
Chapter 9	ENVIRONMENTAL IMPACT ASSESSMENT.....	59
Chapter 10	PORT MANAGEMENT AND OPERATIONS	62
Chapter 11	ECONOMIC ANALYSIS.....	63
Chapter 12	FINANCIAL ANALYSIS.....	65

CONCLUSION
AND
RECOMMENDATIONS

CONCLUSIONS AND RECOMMENDATIONS

Based on Integrated Master Plan for Sea Transportation (Vol.I), feasibility studies of ports of Bitung and Kupang have been implemented.

I-1 CONCLUSIONS

Socioeconomic Profile of North Sulawesi

1. North Sulawesi Province had a population of 2.5 million in 1990, and per capita GRDP excluding oil and gas sector was Rp.515,000, which was 65 per cent of the national average, and its annual growth rate from 1983 - 1990 was 3.6 per cent while the national average showed 5.7 per cent during the same period. Thus, North Sulawesi Province was one of the economically stagnated areas in the eighties in Indonesia.

2. Agriculture was the single most important sub-sector in North Sulawesi Province, and had a 37.0 per cent share of the provincial GRDP in 1990. Several sub-sectors in the tertiary sector also played important roles in the provincial economies such as Public administration & Defense 14.1 %. On the other hand, contribution of Manufacturing industry sub-sector to the provincial economy was minimal, having only a 4.8 % share.

Potential for Development

3. North Sulawesi Province is one of the natural resource rich provinces in Eastern Indonesia. The available natural resources include suitable soil for agriculture, food cropping and animal husbandry, fisheries and minerals. Development of Bitung fishery port will be realized during the coming REPELITA VI in the anticipation of promoting the fishery activities.

4. The government of North Sulawesi has established a 100 hectare industrial area adjacent to the municipality of Bitung. Kabima (Kauditan, Bitung, Kema) Industrial Estate is expected to play the most central role in the industrial activities in the northern part of Eastern Indonesia, and its expansion by 300 hectares has been proposed. In addition, the potential of North Sulawesi for electric power is huge, estimated at 3,000 megawatts. Hydraulic energy can be found on 30 rivers while only 125 megawatts were exploited in 1991. Geothermal energy resources are also found and partially tapped.

5. The provincial government as well as national government is eager to see the northern coastal area of the province near Likupang become the largest resort area in the northern part of Eastern Indonesia. Construction works are under way to widen and to pave the existing narrow strip leading to Likupang. A runway of Manado airport will be extended to 3,000 m from the existing 2,500 m in order to improve its function as an international airport.

6. A new economic zone concept has been proposed. "Triangle Zone of Economic Growth in East ASEAN" involves three islands of four nations, which are Mindanao Island in the Philippines, Sulawesi Island in Indonesia, Borneo Island which is shared by Indonesia, Malaysia and Brunei. Forty million people live in this zone, and this

economic zone concept aims at achieving economic growth in the whole triangle zone by mutually combining natural, agricultural, fishery, and human resources as well as social infrastructures in the zone. North Sulawesi is expected to play vital roles in this concept.

7. As mentioned above, North Sulawesi Province is expected to play leading roles as a development center in the northern part of Eastern Indonesia through utilizing its rich national resources and locational advantages. Industrialization should be promoted to pursue this goal, and Kabima industrial zone will gradually but steadily be activated centering around agro-industry or light industry. More port traffic, especially container traffic, will be generated with the increase of economic activities in the hinterland where an annual economic growth rate of at least 7% is expected. Thus, improvement of infrastructures and strengthening of the gateway function of Bitung port is a must to achieve the regional economic development.

Port of Bitung

8. Port of Bitung is situated on sheltered waters of Lembah Strait at the northern end of Sulawesi Island. The port is not only the principal port of North Sulawesi Province, but also an important base of sea transport linking Sulawesi, Maluku and West Irian Jaya. Public port facilities at Bitung port are managed by the branch office of PERSERO IV as a class two commercial port. ADPEL office, under KANWIL control, supervises the overall port operation as governmental coordinator.

9. At the public port of Bitung, there is Oceangoing Wharf (-9 m) of 605 m in length, Interisland Wharf (-6 m) of 502 m in length, Chemical Based Industry Wharf (-6 m) of 146 m in length, and Local & Sailing Wharf (-5 m) of 60 m in length. PERTAMINA Jetty can be found 400 m to the west from Oceangoing Wharf. To the east of the main quay a new ferry jetty was constructed by DGLT, and its operation commenced on 6 May 1993 between Bitung and Ternate.

10. The public wharves handled 1,176,794 tons of cargo, and 198,209 passengers embarked or disembarked at the port in 1992. Of the total cargo, about 20 percent was exported. Among the unloading cargoes, daily necessities, cement and rice are the major commodities and account for 65 %. Total volume of public cargo increased at an annual growth rate of 7.85 % from 1984 to 1992. Average Berth Occupancy Ratio of the entire port was 64 %, and Berth Throughput was 1,270 ton/m at Oceangoing Wharf and 310 ton/m at Interisland Wharf in 1992.

11. Container handling at the port of Bitung started before 1984. Since then container traffic has shown a steady increase, and reached 70,226 tons in 1992. The annual growth rate of the container traffic at the port during past years has been about 30 % and is expected to keep its high growth rate even in future. The port of Bitung, however, is presently lacking adequate container handling capability, and it has been asserted that this insufficiency of the container handling capability at the port of Bitung is one of the serious hindrances to the economic development of North Sulawesi.

12. Because the port of Bitung is located near downtown Bitung, traffic generated from port activities sometimes caused 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.

Short Term Development Plan

13. Short term development plan for the port of Bitung for the year of 2000 has been made. The following development policies are set;

- (a) Bitung port should not be a hindrance to regional economic development
- (b) Container handling capability of the Bitung port should be significantly improved
- (c) Bitung port should be improved as the gateway port in the northern part of Eastern Indonesia

14. Based on the above development policies, the following planning framework is agreed among DGSC, PERSERO IV, and JICA study team;

- (a) Port of Manado will be closed and converted to a marina.
Existing function of Manado port will be moved to Likupang port.
- (b) Fishery boats at Bitung port will be moved to a new fishery port
- (c) Cement packing plant will be constructed at Interisland Wharf

15. The cargo throughput at the year of 2000 is estimated at 2,119,000 tons including 332,000 tons of containerized cargo. Two hundred and sixty seven thousand tons of cement, which is the major solid bulk cargo at the port, will be transported by cement bulk carriers.

16. Based on the evaluation of cargo handling capacity of the existing berths, construction of a specialized container berth with yard and a bulk cement berth is proposed to accommodate the anticipated seaborne traffic. Alongside water depth of the above berths is 7.5 m. The site which is located between the existing Interisland Wharf and the Ferry Jetty is proposed for the location of the new berthing facilities. A passway along Interisland Wharf should also be developed to smoothen traffic in the port area. Equipment for handling containers and heavy cargoes is proposed for procurement as well as vessels for port operation. Development of an access road is also proposed to avoid traffic congestion around the port area.

17. Preliminary design for new infrastructures was carried out based on the actual soil data obtained through the natural condition survey. Calmness at the basin was also taken into consideration when type of structures was selected. Locally produced materials and precast members manufactured on land were encouraged to be used in the construction works. Pier type with pile foundations was selected as the most suitable structural type for both the berths.

18. Cost estimation was carried out based on the preliminary design of the major facilities and the implementation program. It will take two years each for the construction works of both Bulk Cement Berth and Specialized Container Berth. Total construction cost of Bulk Cement Berth amounts to Rp. 20,521 million and foreign portion is Rp. 4,993 million accounting for 24.3 %. On the other hand, total construction cost including infrastructure, superstructure, and equipment of Specialized Container Berth with yard amounts to Rp. 52,197 million and foreign portion is Rp. 19,436 million accounting for 37.2 %.

19. Environmental Impact Assessment concerning the port development of Bitung was carried out for the three stages: port construction stage, port existence stage, and port utilization stage. Computer simulation technique is applied to investigate possible magnitude of environmental impact regarding water quality. It is estimated that the impact to the environment around Bitung port by this project will be permissibly small.

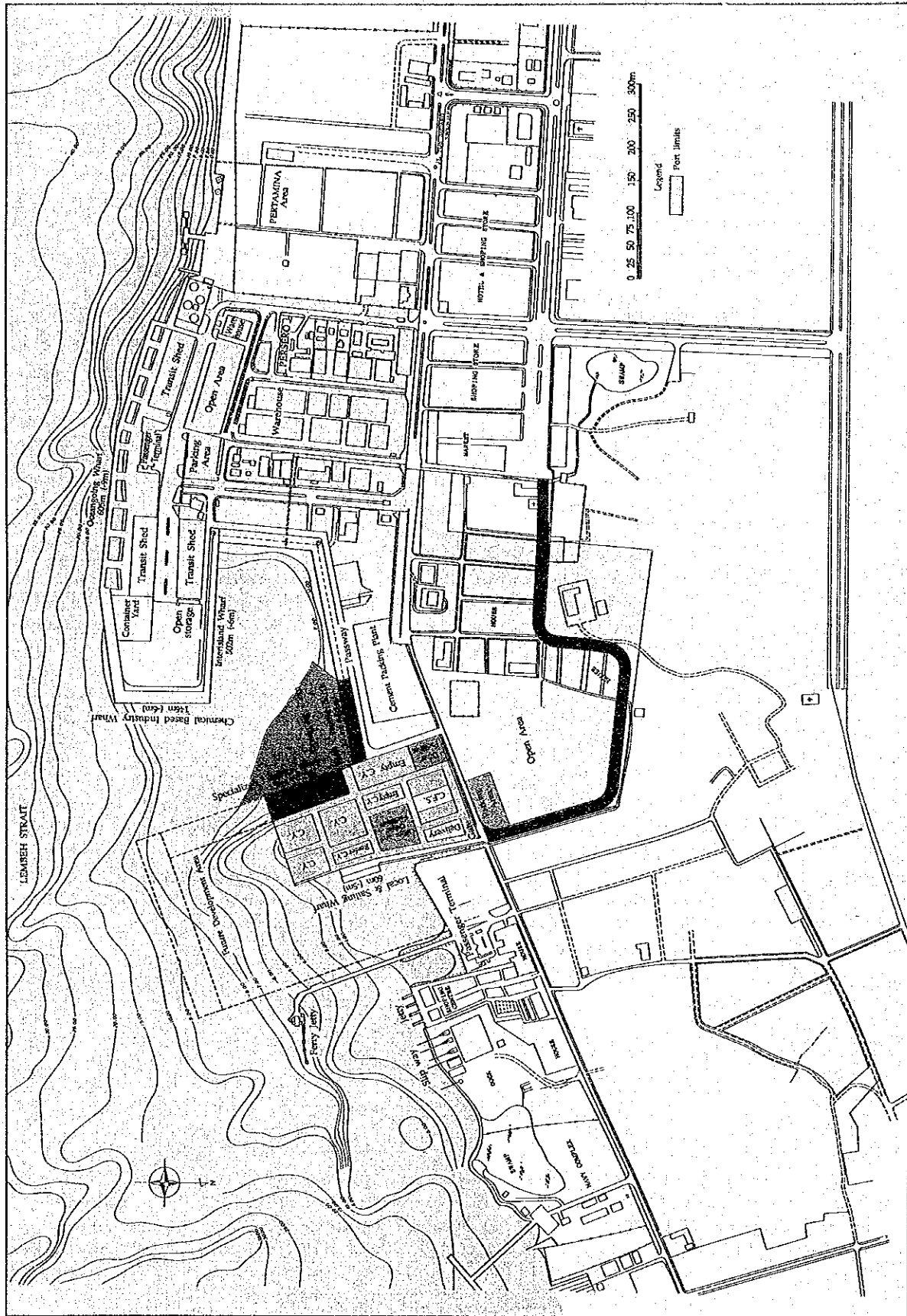


Figure 1 Bitung Port Development Plan (2000)

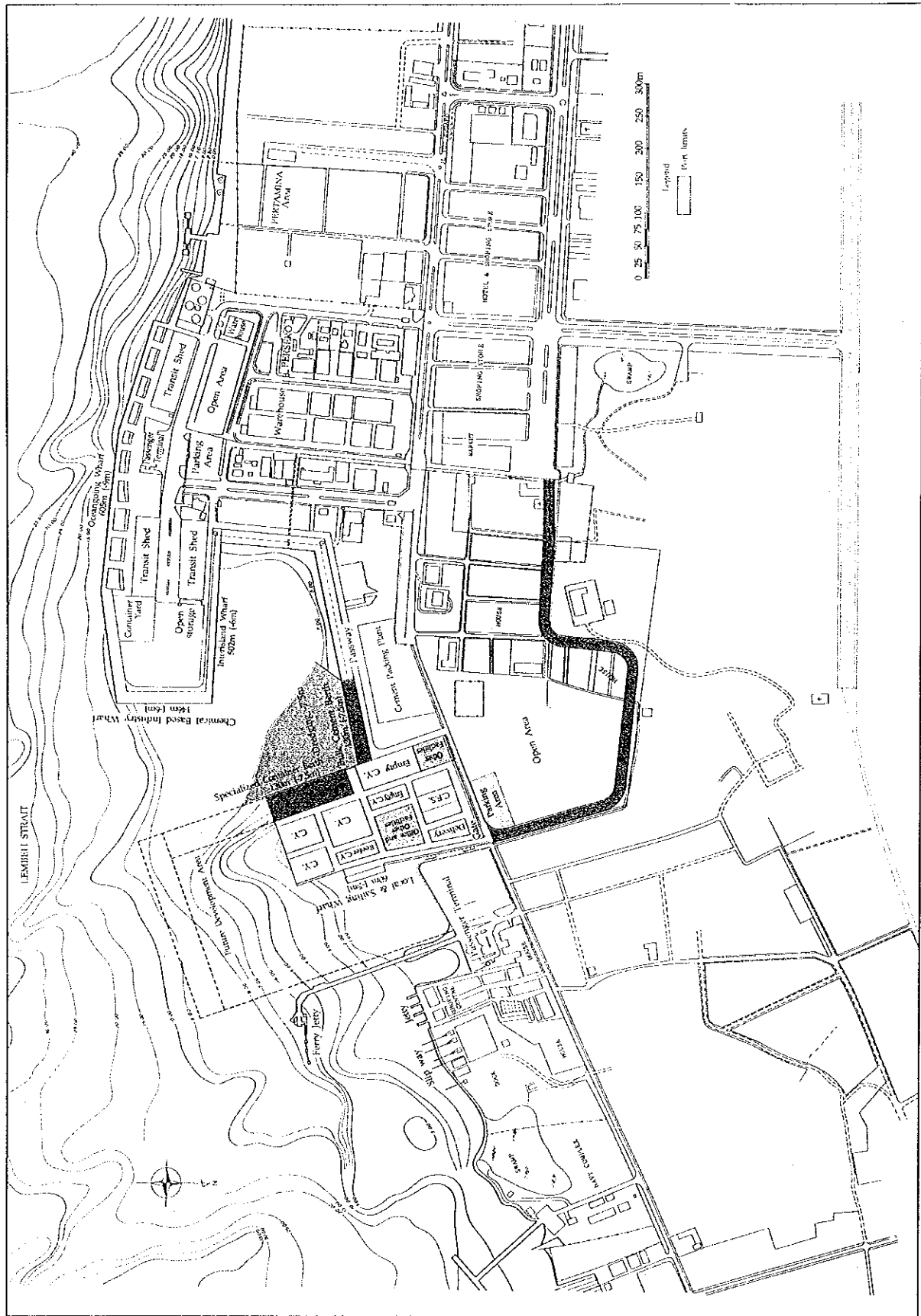


Figure 1 Bitung Port Development Plan (2000)

20. Evaluation from national economy point of view of the development project of the Bulk Cement Berth and the Specialized Container Berth was carried out by the internal rate of return (IRR) calculated through cost benefit analysis. Economic benefit is mainly accrued from the saving in ship's waiting time for berthing. Calculated IRR for the new berths is 16.4% under a 30-year project life. This figure clearly exceeds the international benchmark. Accordingly, this project can be considered economically feasible.

21. The viability of the project is analyzed using the Financial Internal Rate of Return (FIRR) by means of the discount cash flow method. The influence on the financial soundness of the port management body during the project life is also analyzed based on its projected financial statements. The FIRR is calculated as 7.5 %, which exceeds 2.21% of the weighted average interest rate of the funds in this study, and PERSERO IV will need only nine years after starting operation to clear cumulative deficit in case that total construction costs are borne by the government. The project can be regarded as financially feasible if the government funds are raised in this manner.

I-2 RECOMMENDATIONS

In accordance with the results of the study and the results of the discussions with the counterpart institutions and the team, it is recommended that the Government of Indonesia implement the Development Project of the port of Bitung with the target year of 2000 to cope with the forecast demand of port traffic and promote economic development of the hinterland region.

Projects Included in the Feasibility Analysis

1) Specialized Container Berth

- Project site : Present Port of Bitung
- Dimensions : Terminal area 4.3 ha
- Berth : Length 130 m, Water depth 7.5 m
- Revetment : Length 400 m
- Reclamation : 62,000 m³
- Main facilities:
 - Apron : 5,200 m²
 - Container yard : 15,000 m² (Excluding road)
 - CFS : 1,800 m²
 - Parking area : 3,500 m²
 - Other facilities : 2,500 m²
- Access road : Length 810 m, Width 17 m
- Onshore Mechanical Equipment
 - Container handling mobile crane (35t) 1 unit
 - (50t) 1
 - Tractor units (tug master) 3
 - 12m trailers 3
 - Reach stacker crane (top lifter) (35t) 1
 - Forklift trucks (2t) 2
 - Forklift trucks (10t) 1

2) Bulk Cement Berth

- Project site : Present Port of Bitung
- Berth : Length 130 m, Water depth 7.5 m
- Revetment : 150 m
- Other facility : Apron 2,600m²

3) Floating Craft for Port Operation

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

Port Operation

- (a) Introduction of flexibility in gang formation for cargo handling
- (b) Maintaining the cargo handling equipment in good condition
- (c) Training and improvement of working conditions for port labor
- (d) Effective utilization of open yard
- (e) Specialization of the wharf step by step
- (f) Establishment of a new sub division to operate the Specialized Container Berth and yard

Environmental Preservation

- (a) When dredging is carried out, silt protector should be set up around the dredging area.
- (b) Reclamation works should be started after revetments are completed.
- (c) The sewage generated by port activities must be treated adequately.
- (d) Bilge generated by vessels must be treated adequately.
- (e) Drainage generated by civic life should not flow into the closed port sea area.

II. Feasibility Study of Port of Kupang

II-1 CONCLUSIONS

Socioeconomic Profile of East Nusa Tenggara

22. East Nusa Tenggara Province had a population of 3.3 million in 1990, showing a population growth rate of 1.79% from 1980, which was one of the lowest growth rates in Eastern Indonesia. Per capita GRDP excluding oil and gas sector was Rp.314,000 in 1989, which was only 39 per cent of the national average. Furthermore, its annual growth rate was 3.4 per cent, which was far below the national average of 5.7 per cent during the same period. Thus, East Nusa Tenggara was one of the least developed provinces in Indonesia.

23. In East Nusa Tenggara Province, approximately 85% of the population earned their living in the agriculture sector. The agricultural sector played a dominant role in the formation of the GRDP of this province with its contribution of 50.1% in 1990. The second largest sub-sector in the provincial GRDP was Public administration & Defense with the contribution of 15.7%. On the other hand, the industrial sector had grown very slowly as seen in its contribution of only 2% to GRDP.

Potential for Development

24. 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.

25. 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.

26. There is another cement production project at Kupang. Memorandum of understanding has been exchanged between Czech (formerly Czechoslovakia) government and 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.

27. 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.

28. 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.

29. 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. 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.

Port of Kupang

30. Port of Kupang is situated near the west end of the Timor Island, and is the main deep water port for East Nusa Tenggara Province. The port is generally well protected by Semau Island from the waves coming from the west. Public port facilities at Kupang port are managed by the branch office of PERSERO III as a class three commercial port.

31. The public facilities are composed of Interisland Wharf of 223 m in length for interisland cargo vessels and Local Wharf of 100 m in length for sailing ships and passenger vessels. Both have around 8 m water depth alongside. The private port facilities along Semau Strait consist of a fishery jetty and a PERTAMINA tankfarm. The former is connected to the shore by a causeway at a distance of about 250 m south of the Interisland Wharf. The latter has an unloading facility further south of the fishery jetty.

32. A total of 309,582 tons of cargo was loaded or unloaded at the public wharves in 1992. The port is characterized as a general cargo port for the province as well as an industrial port of the cement factory. Total cargo traffic has been increasing at an annual growth rate of 12% from 1984 to 1992.

33. Average Berth Occupancy Ratio of the port has been fluctuating over past years such as 89% in 1990 and 57% in 1992. Average Berth Throughput of the port has a clear peak in 1990 with 1,027 ton/m, and its value in 1992 was 781 ton/m.

34. Container handling at the port of Kupang started in 1990, and is still at the initial stage of development although container traffic is growing steadily. Container vessels with ship gears regularly call the port from Darwin to load containers which are stuffed with sandalwood for foreign markets. Domestic semi-container ships are also plied between Kupang and Surabaya.

Short Term Development Plan

35. Short term development plan for the port of Kupang for the year of 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

36. Besides 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.

37. A total of 741,000 tons of cargo is forecast at the port in 2000. Cement-related cargoes, which are the major commodity group of the port, will reach a total of 401,000 tons a year. Containerization ratio is forecast at 10 %, and 22,000 tons of container cargo will be handled at the port in 2000.

38. Construction of Cement Berth and Heavy Cargo Berth is proposed to accommodate the anticipated seaborne traffic. Alongside water depth of the above berths is 7.5 m. The site which is located between the existing Interisland Wharf and the Fishery Jetty is proposed for the location of the new berthing facilities. A 30 m-wide waterway which passes through the Cement Berth is also proposed to avoid flushing at the rainy season. Development of Rakyat Wharf and extension of Local Wharf are needed to accommodate the anticipated traffic at the port in 2000 although they are treated as on-going projects in this study. Equipment for handling containers and heavy cargoes is proposed for procurement as well as a vessel for port operation. Development of access road is also proposed to smoothen container traffic between the public port and the proposed industrial area.

39. Preliminary design for new infrastructures was carried out based on the actual soil data obtained through the natural condition survey. Locally produced materials and precast members manufactured on land were encouraged to be used in the construction works. Pier type with pile foundations was selected as the most suitable structural type for both the Cement Berth and the Heavy Cargo Berth.

40. Cost estimation is carried out based on the preliminary design of the major facilities and the implementation program. It will take two years each for the construction works of both the Cement Berth and Heavy Cargo Berth. Total construction cost of the former amounts to Rp. 21,451 million and foreign portion is Rp. 1,544 million accounting for 7.2 %. On the other hand, that of the latter with a yard and equipment amounts to Rp. 18,346 million and foreign portion is Rp. 3,317 million accounting for 18.1 %.

41. Environmental Impact Assessment concerning the port development of Kupang was carried out in the same manner as the development study at the port of Bitung. It is estimated that the impact to the environment around Kupang port by this project will be permissibly small.

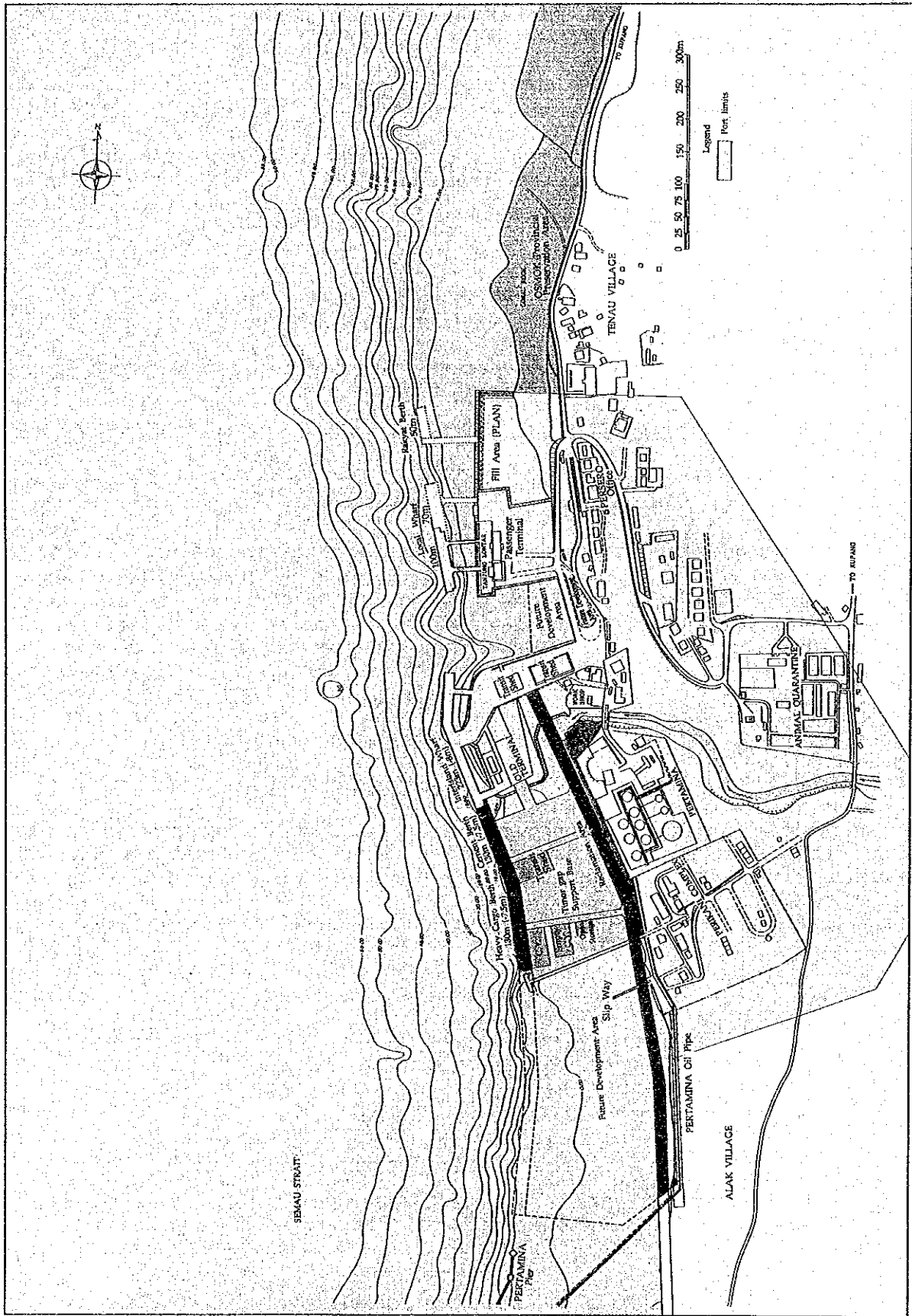


Figure 2 Kupang Port Development Plan (2000)

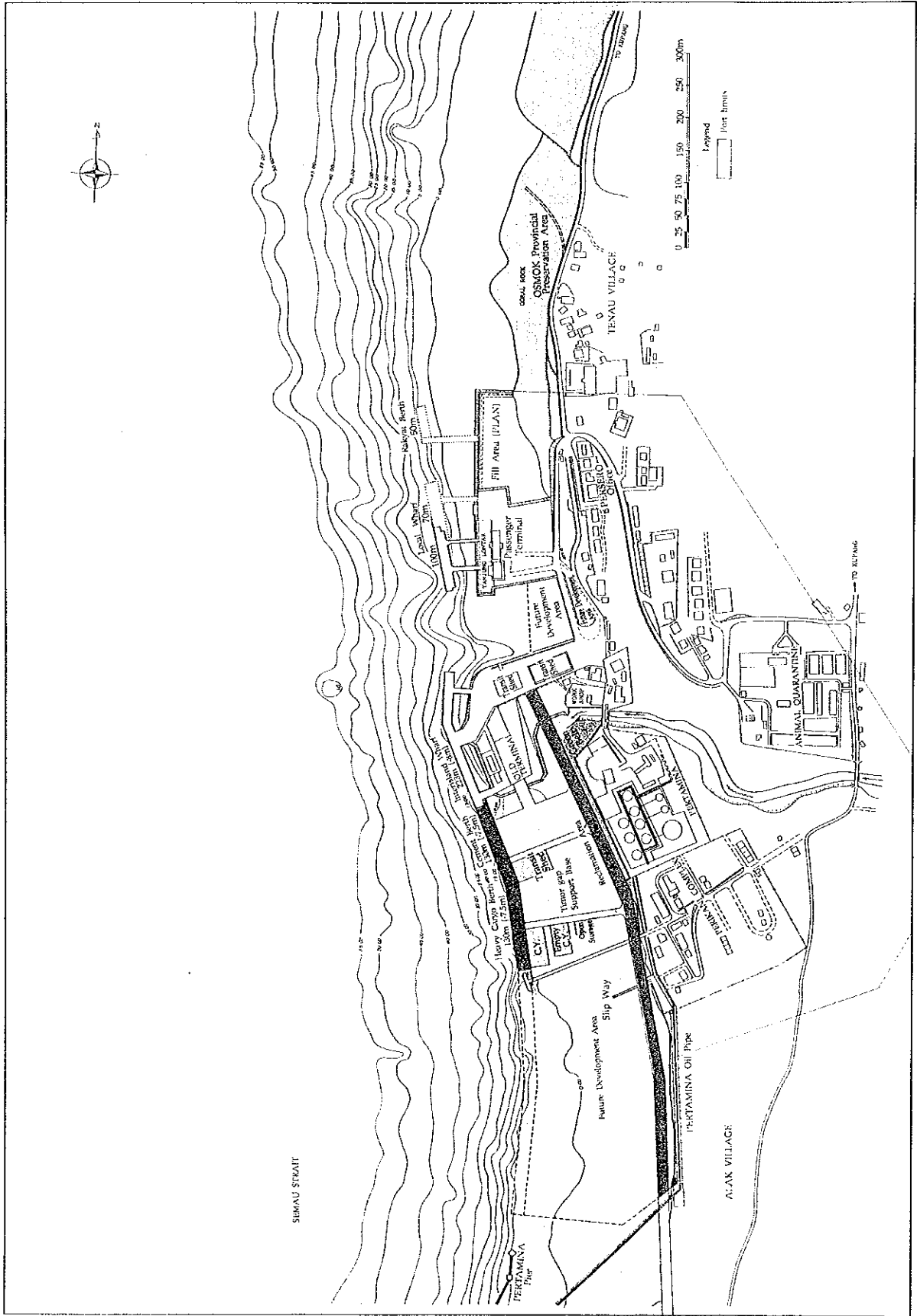


Figure 2 Kupang Port Development Plan (2000)

42. Economic analysis is carried out for the development project of the Cement Berth and the Heavy Cargo Berth. Economic benefit is generated from the saving in ship's waiting time for berthing. Calculated IRR for the new berths is 15.3% with a 30-year project life, and exceeds the international benchmark. Accordingly, this project can be considered economically feasible.

43. The Financial Internal Rate of Return (FIRR) is calculated for the development project at the port of Kupang. The influence on the financial soundness of the port management body during the project life is also analyzed based on its projected financial statements. The FIRR is calculated as 5.9 %, which exceeds 2.21% of the weighted average interest rate of the funds in this study, and PERSERO III will need ten years after starting operation to clear cumulative deficit in case that total construction costs are borne by the government. The project can be regarded as financially feasible if the government funds are raised in this manner.

II-2 RECOMMENDATIONS

In accordance with the results of the study and the results of the discussions with the counterpart institutions and the team, it is recommended that the Government of Indonesia implement the Development Project of the port of Kupang with the target year of 2000 to cope with the forecast demand of port traffic and promote economic development of the hinterland region.

Projects Included in the Feasibility Analysis

1) Cement Berth

- Project site : Present Port of Kupang
- Berth : Length 130 m, Water depth 7.5 m
- Other Facilities:
 - : Apron 2,600 m²
 - : Shed 1,700 m²
- Revetment : 240 m
- Reclamation : 64,000 m³
- Waterway : Length 100m, Width 30 m

2) Heavy Cargo Berth

- Project site : Present Port of Kupang
- Berth : Length 130 m, Water depth 7.5 m
- Revetment : Length 300 m (including an existing 175 m causeway)
- Reclamation : 96,000 m³
- Main facilities:
 - Apron : 2,600 m²
 - Container yard: 3,200 m²
 - Open storage : 600 m²

- Other facility: Timor Gap Support Base: 14,000 m2
 - Onshore Mechanical Equipment
 - Heavy duty mobile crane (50t) 1 unit
 - Forklift trucks (24t) 1
 - Forklift trucks (2t) 1
 - Access road: Length 1,150 m, Width 17 m
- 3) Floating craft
- Tug : (2 x 400 HP) 1 unit

Port Operation

- (a) Introduction of flexibility in gang formation and allocation of port labor
- (b) Adequate coordination with land transport by truck
- (c) Maintaining cargo handling equipment in good condition
- (d) Training and improvement of working conditions for port labor
- (e) Specialization of cargo handling at the Cement Berth

Environmental Preservation

- (a) Reclamation works should be started after revetments are completed.
- (b) The sewage generated by port activities must be treated adequately.
- (c) Bilge generated by vessels must be treated adequately.
- (d) When bulk cargoes are handled, any cargo handling system in which diffusion of dust can be prevented should be adopted.

PART I

FEASIBILITY STUDY OF PORT OF BITUNG

Chapter 1 SOCIO-ECONOMIC PROFILE OF NORTH SULAWESI PROVINCE

Geographical features

1. The North Sulawesi province, where the port of Bitung is located, is one of the four provinces in Sulawesi Island, the others being, Central Sulawesi, South Sulawesi and South East Sulawesi province. This province is bounded on the north by the Sulawesi Sea, on the south by Banda Sea, on the east by Maluku Sea, and the west by the Central Sulawesi province. The North Sulawesi province has a total land area of 2,748,763 ha (1.4 % of Indonesia's total land area).
2. The north Sulawesi province belongs to the tropical zone. This area is affected by monsoon winds with two regular seasons, that is, dry season (from April to September) and rainy season (from October to March).

Administrative subdivision

3. There are three municipalities, four regencies, 85 sub-districts and 1,374 villages in this province. (refer to Figure 1-1)

Demographic features

4. As of the 1991 Result of Population Registration at End of Year, the province has a total population of 2,493,251 with an average ratio of 91 persons per square kilometer.

Economic and industrial features

5. There are multifarious natural resources (Agriculture, Maritime and Mineral) in the North Sulawesi province.
6. The agriculture sector of GRDP has the largest share in this province. Regarding the growth rate of GRDP by sector, the mining & quarrying sector and the banking & other financial intermediaries sector had higher growth rate than that of the other sectors. (refer to Table 1-1)

Infrastructure

7. The existing road length in the North Sulawesi province reaches about 6,900 km. Also there are 38 public ports in the North Sulawesi province, of which three are managed by PERSERO, and the other 35 ports are under KANWIL management. In addition as for air transportation sector, there are four airports in this province. Sam Ratulangi (Manado municipality) is the main airport in this province.

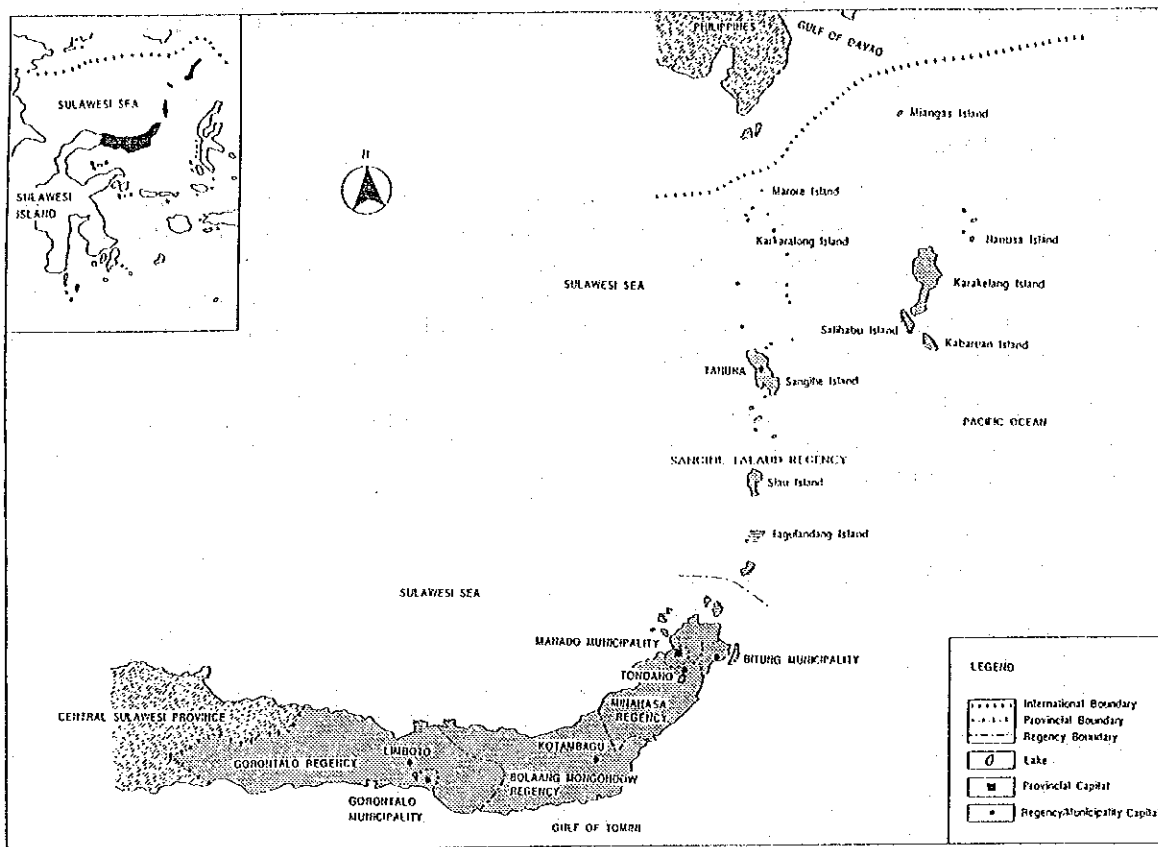


Figure 1-1 Administrative Division North Sulawesi Province

Table 1-1 GRDP of North Sulawesi Province at Constant Prices by Origin (1983-1990)

Unit: Million Rp. (1983 prices)

Industrial Origin	Year									Growth. R (%) ('83-'90)
	1983	1984	1985	1986	1987	1988	1989	1990		
Agriculture	240,930	224,218	234,223	249,439	267,844	292,095	307,570	354,018	5.65	
Mining & Quarrying	2,766	2,906	3,183	3,546	4,204	6,385	7,166	8,492	17.38	
Manufacturing industries	36,261	38,377	40,073	37,919	39,227	40,111	42,739	45,973	3.45	
Elect., Gas & Water supply	5,423	5,633	6,122	6,839	7,220	7,978	8,662	9,418	8.20	
Construction	40,547	44,652	49,331	44,495	44,576	45,828	47,080	48,516	2.60	
Trade, Resturant & Hotel	90,157	92,193	94,374	97,304	102,244	110,256	116,945	126,928	5.01	
Transport & Communication	76,682	81,220	83,422	87,115	93,308	102,477	108,343	116,053	6.10	
Banking & Other financial intermediaries	11,660	12,646	10,666	11,199	13,309	18,388	26,840	33,413	16.23	
Ownership of dwelling	20,033	20,454	20,883	21,244	22,148	23,088	24,067	25,093	3.27	
Public adm. & Defence	105,043	113,232	115,496	121,447	125,645	127,149	130,964	134,751	3.62	
Services	42,148	45,749	46,778	49,461	50,116	51,270	52,911	54,827	3.83	
Total	671,650	681,280	704,551	730,008	769,841	825,025	873,287	957,482	5.20	

Source: BIRO PUSAT STATISTIK JAKARTA-INDONESIA

Chapter 2 PRESENT SITUATION OF THE PORT OF BITUNG

Municipality of Bitung

1. Bitung municipality is situated on the northeastern part of the North Sulawesi province. This municipality has a total land area of 30,400 ha (1.1 % of the province's total area). As of the 1991 Result of Population Registration at End of Year, this municipality has a total population of 102,553 with an average ratio of 337 persons per square kilometer. The climate in this area is tropical with high temperatures and high humidity.

Port related industries

2. The port of Bitung is the principal port in the North Sulawesi province. Therefore, many kinds of port related industries are located in this municipality. The major port related industries are Pertamina (Oil industry), Canning industry, Coconut oil industry and Shipbuilding industry.

Shipping routes

3. According to the ship call record at this port, most of the international shipping routes belong to "Bitung - Philippines route (i.e., Bitung - General Santos route). On the other hand, Pelni passenger ships and Perintis line call at the port of Bitung as interisland shipping.

4. The port of Bitung has been handling container cargoes. International container shipping routes are also in operation. Ferry operation between Bitung and Ternate started 6 May 1993.

Port facilities

5. The berthing facilities at the port of Bitung are managed by PERSERO, DGLT and private companies. The public wharves (Oceangoing, Chemical Based Industry, Interisland and Local & Sailing wharf) are managed by PERSERO. (refer to Figure 2-1)

6. The oceangoing wharf (length: 605 m, water depth: -9.0 m) is the main berth of this port.

7. The chemical based industry wharf (length: 146 m, water depth: -6.0 m) was originally constructed as a bulk cement berth of this port. But the cement packing plant behind this berth has not been constructed so far, therefore, this berth is used by oceangoing vessels and interisland vessels as well as fishery boats.

8. The interisland wharf (length: 502 m, water depth: -6.0 m) is mainly used by interisland vessels, but when the berths of the oceangoing wharf are full, oceangoing vessels berth at this wharf.

9. The local and sailing wharf (length: 60 m, water depth: -5.0 m) is used by local vessels and sailing vessels.

10. The ferry jetty managed by DGLT is located on the east side of this port.

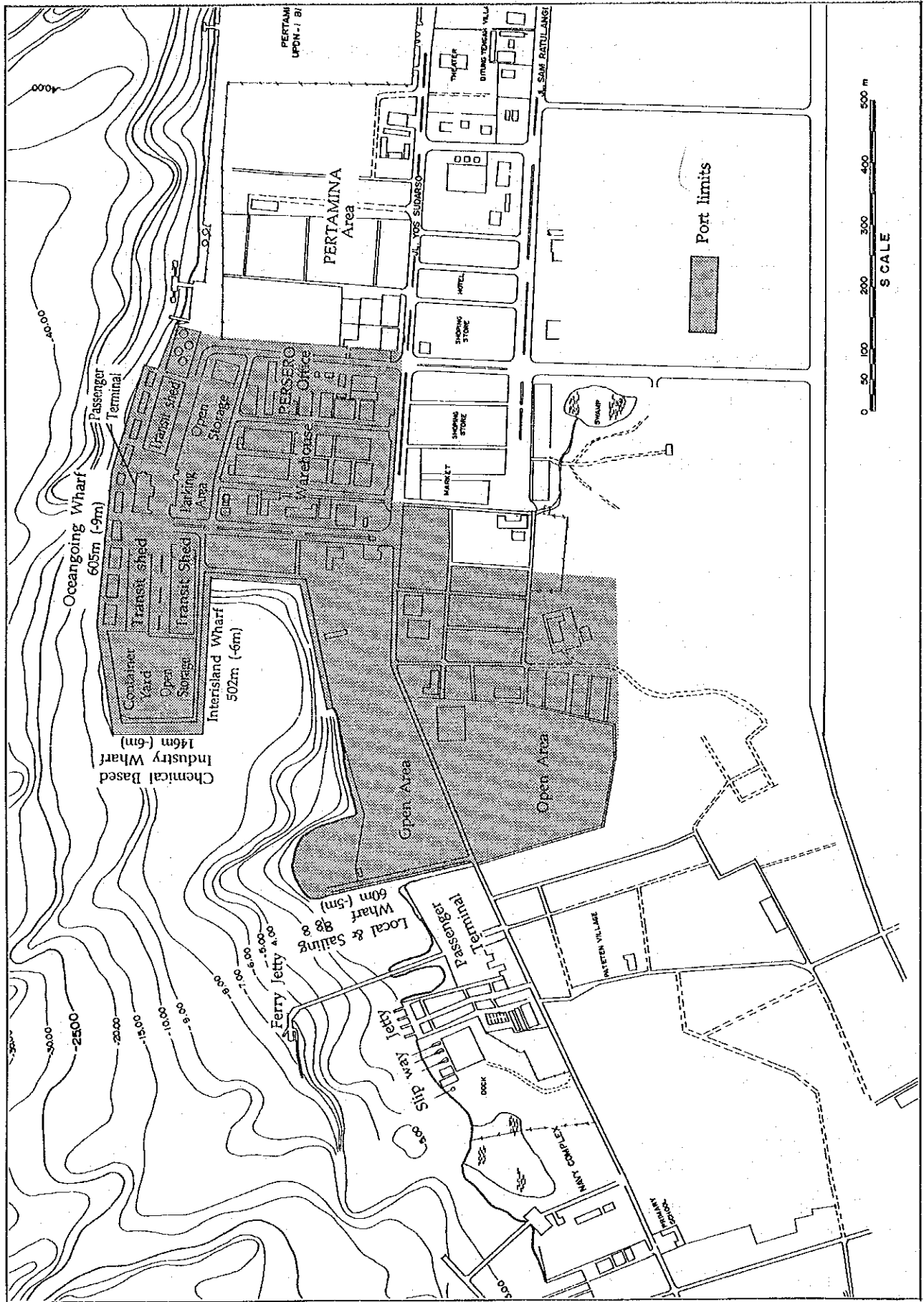


Figure 2-1 Existing Facilities of Bitung Port

One dolphin for oil tankers and concrete piers for loading small tankers exist on west side of this port.

11. There is 12,960 m² of transit sheds behind the oceangoing wharf. This port also has 22,548 m² of warehouses at the center of this port. On the other hand, there are 15,500 m² of open storage areas and 4,000 m² of container yard.

Cargo handling volume

12. A total of 1,176,794 tons of cargo was handled at this port in 1992, breaking down, 28,845 tons for import, 96,243 tons for export, and 876,844 tons for domestic unloading, and 174,862 tons for domestic loading.

13. Total volume of public cargo has been increasing at the annual growth rate of 7.85 % from 1984 to 1992. Annual growth rates of the domestic loading and unloading were almost identical during this period, that is 7.78 % and 7.66 %.

14. Main commodities of import at this port have been foodstuffs and construction materials. On the other hand, main commodities of export have been agriculture products such as coconut oil and copra.

15. 547,527 tons, which accounted for 47 % of total cargo in 1992, were transported in the form of break bulk. Bag cargo was the second largest group, 372,649 tons, or 32 % of total. Volume of the containerized cargo at Bitung was 70,226 tons in 1992.

16. It can be estimated that majority of cargoes, especially consumer goods, comes from East Java (Surabaya), South Sulawesi (Uj.Pandang), and Jakarta. These three provinces and district claim 95 % of areas of origin of cargoes to North Sulawesi province. On the other hand, 32 % of the out going cargoes are destined for Maluku province; Ternate is one of the major destination point of outgoing cargoes.

Passenger traffic

17. The total passenger traffic increased steadily during 1984-1992. The average annual growth rate was more than 12 % during the said period. Number of passenger in 1992 was 198,209, which was the largest in number ever recorded at the port of Bitung.

Calling vessels

18. A total of 2,632 vessels including Pertamina special shipping made calls to the port of Bitung in 1992. Gross Registered Tonnage of the calling vessels totaled 3,720,310 in 1992.

Facility utilization

19. In general, the utilization level of the berthing facilities is evaluated by Berth Occupancy Ratio (BOR) and Berth Throughput (BTP). The average BOR of all berthing facilities at this port steadily increased from 1984 to 1992. There was an

upward trend regarding the average BTP of all berthing facilities at this port.

Port management and operation

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

Port labor and operation

21. There are seven cargo handling companies including service division of PERSERO office itself in the port of Bitung. The number of registered port labors working at Bitung port is 1,511. Port labor is supplied by a port labor cooperative organization known as KOPERASI TKBM. Also cargo handling is conducted approximately 320 days per year. Port labors usually work two shifts a day in this port but third shift is available in case of request from users.

Financial statements of PERSERO IV and port of Bitung

22. As for financial statements of PERSERO IV, operating ratio and working ratio has improved substantially. The value in 1991 (operating ratio: 96.6 %, working ratio: 71.2 %) shows the efficient financial conditions prevail at PERSERO IV. As for the liquidity, the value of current ratio of PERSERO IV has been at a very high level (above 600 % in 1991) and it can furnish working capital easily to branch offices which run a deficit.

Review of the existing plans

23. The port development at Bitung port has been based on the master plans which were formulated by the foreign consultants or Indonesian consultants. The newest existing master plan was formulated by Planning Research Corporation (PRC Engineering, Inc.) and P.T. Soilens in April 1984.

Chapter 3 NATURAL AND ENVIRONMENTAL CONDITIONS

A. Meteorological Conditions

Climate

1. Sulawesi Island belongs to the tropical climate zone with high air temperature and humidity. However, the climate quite varies locally due to the complicated mountain range running in several directions. At the peninsula of North Sulawesi, northwest monsoon wind prevails from december to March with high precipitation, while the southeast monsoon wind is prevalent with low precipitation from June to September.

Temperature and humidity

2. Mean temperature ranges from 25°C to 26°C throughout the year and its annual fluctuation is below 2°C. Mean maximum temperature ranges from 29°C to 32°C and mean minimum temperature is 23°C throughout the year. The temperature fluctuation in a day is 6°C to 8°C. Relative humidity is generally high, especially in the morning, and the mean relative humidity is within the range from 74% to 87%.

Precipitation

3. Annual mean precipitation is 2,716mm. Low precipitation is observed in the dry season from July to October, and the lowest monthly mean precipitation falls to 87mm in September. High precipitation is recorded in the rainy season from December to March, and the highest monthly mean precipitation reaches 478mm in January. Localized heavy rain shower often occurs in the rainy season.

Wind

4. NE wind prevails from November to April as northeast monsoon, and SW wind is prevalent from May to October as southwest monsoon, which exceeds at times 15m/s in the afternoon mainly due to the superposition of sea breeze and monsoon.

Cloud cover

5. Cloud cover is 5 in the rainy season and 4 in the dry season, where the full cover is defined as 10.

B. Topographical Conditions

6. Bitung Port (1°26' N and 125°12' E) is located on the southeastern coast at the north end of Sulawesi, facing the southwest side of the Lembeh Strait, 0.7 to 2km wide, between lembeh and Sulawesi, and about 16km long in the NE-SW direction. Lembeh is a long narrow island (1 to 5km wide and 23km long) with the hills 200 to 450m high.

7. Mt. Dudasudara 1,351m high and Mt. Batu Angus 1,109m high, both volcanic mountains, rise at the location of 7 to 8km inland from the coastline of Sulawesi. Bitung Port has a very narrow flatland rearwards blocked by these mountains, but is sheltered by Lembah as a natural haven from the wave attack.

C. Bathymetric Conditions

8. A trough approximately 40m deep runs in the east-west direction along the mediate axis at the west opening of the Lembah Strait, where the seabed is scarcely covered with sediments. The coastline of Lembah is rather indented.

D. Hydrographic/Oceanographic Conditions

Tide

9. According to the harmonic analysis of tide, semi-diurnal tide is prevailing in Bitung Port. HWL and LWL are fixed at +1.90m and +0m, respectively in the JICA Report 1978.

Current

10. Semi-diurnal tide prevails and current speed reaches around 1m/s in the center of the Lembah Strait. currents reciprocate parallel to the coastline in the E-W to NE-SW directions. Flood currents toward E to NE surpass ebb currents toward W to SW. During spring tide, flood currents reach 40 to 90cm/s (30 to 80°), though ebb currents reach 10 to 50cm/s (150 to 170°), where current direction is measured clockwise from the north.

Wave

11. Waves are predicted, based on the wind data in 1991 observed in Bitung, for they have never been observed in Bitung Port. Waves travel from SSW-SW and ENE. Maximum significant waves are predicted as 0.50m and 2.1s to 1.91m and 4.9s.

Littoral drift

12. Judging from the survey results conducted in July 1977, sand on the shore west of the existing wharf will be possibly carried toward the wharf by waves from may to October. Because there exists no eroded or aggraded beach around the port, some sand transported to the western edge of the existing wharf will be returned to the coast west of the wharf from November to April, and some will be transported to the east of the wharf by tidal or longshore currents.

E. Geological Conditions

13. Sulawesi belongs to the tectonically unstable zone extending in the southeast direction from the Indo-China to the Makassar Strait lying east of Kalimantan. North Sulawesi is situated at the southern edge of very active seismic zone extending to the Mindanao Island, the Philippines.

F. Seismic Activity

14. In North Sulawesi belonging to the Pacific Volcanic Belt, an earthquake frequently occurs. Volcanoes are still active in the region covering from North Sulawesi to Sangihe Islands, and earthquakes sometimes occur in Bitung area. Seismic acceleration in and around Bitung area is classified as 0.07 to 0.15g.

15. Earthquakes often occur in North Sulawesi, Sangihe Islands and Halmahera. Fortunately, Bitung Port has never suffered from the damage caused by tsunami. However, it can be attacked by tsunami, for the epicenters are centered in the Maluku Sea.

G. Soil Conditions

16. Previous soil surveys were conducted by JICA in 1978. The boring surveys carried out for the present study aimed at verifying: (1) existence of hard basement layer below the surface layer of seabed east of the public wharf, and (2) soil composition of seabed near the coast of the Lembeh Island.

17. Slope of the seabed along the line parallel with the existing ferry berth is 1:80, with the surface layer composed of sand mixed with gravel and coral fragments, 10m to 20m thick in the direction of offing, while the underlying layer of medium hard silty sand varies from 10m to 3m thick. A dense layer with N value over 50 exists at the elevation of -30m to -36m.

18. Surface layer along the line parallel with the shoreline around the wharf is composed of sand mixed with gravel and coral fragments and partly contains the soft clayey materials in the middle. A dense layer of sand underlies the surface layer uniformly at the elevation of -30m, but at the seabed near the wharf the hard layer is found at the elevation of -10m. No loose layers exist near the navy jetty.

19. Soil composition of the seabed near the coast of the Lembeh Island is generally similar to that of the seabed in the port area, but a dense layer of sand, exists at the shallower elevation of -25m.

H. Environmental Conditions

20. Water quality surveys were carried out in Bitung Port in July to August 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 (26 to 27°C), salinity (3.3%), pH (8.2 to 8.3), dissolved oxygen (7.2 to 8.3 mg/l), transparency (water depth to 16m), COD (20 to 60mg/l), SS (15 to 30mg/l) and turbidity (6.0 to 7.0 NTU).

Chapter 4 DEVELOPMENT POTENTIAL OF THE PORT HINTERLAND

Development potential of the primary sector

1. North Sulawesi province is one of the natural resource rich provinces in Eastern Indonesia. The available natural resources include suitable soil for agriculture, food cropping and animal husbandry, fisheries and minerals.
2. The size of North Sulawesi's production forest is around 940,000 hectares, with another 293,000 hectares which can be converted to production.
3. The seas around North Sulawesi are rich in marine life, and it is estimated that annual production within 12 miles offshore is about 125,000 tons and that within the Exclusive Economic Zone is 196,000 tons. Development of Bitung fishery port will be realized during the coming Repelita VI in the anticipation of promoting the fishery activities.

Development potential of the secondary sector

4. At the end of REPELITA IV, Sulawesi was one of the eight industrial growth centres identified in the nation. Several types of manufacturing factories are already in operation; they include three shipyards, three coconut oil factories, two tuna canning factories, two oxygen factories, two rattan furniture factories, a coil factory, and a can manufacturing factory. In 1990, an activated carbon manufacturing factory was established with production capacity of 10,000 tons per year, and its products are being exported.
5. The government of North Sulawesi has established a 100 hectare industrial area adjacent to the municipality of Bitung. Kabima (Kauditan, Bitung, Kema) Industrial Estate is expected to play the most central role in the industrial activities in the northern part of Eastern Indonesia, and its expansion by 300 hectares has been proposed.
6. The potential of North Sulawesi for electric power is huge, estimated at 3,000 megawatts. Hydraulic energy can be found on 30 rivers while only 125 megawatts were exploited in 1991. Geothermal energy resources are found and partially tapped. The conservation of this energy is estimated at 600 megawatts.

Development potential of the tertiary sector

7. More tourists are traveling to North Sulawesi every year; they are attracted by active volcanoes, lakes, hot springs, national parks, and coral islands with superb snorkeling and diving. In 1992, more than two hundred thousand tourists visited North Sulawesi province, of which 13,078 were international tourists. Cruising vessels with some 5,000 GRT from Australia visited the Port of Bitung.
8. The provincial government as well as national government is eager to see the northern coastal area of the province near Likupang become the largest resort area in the northern part of Eastern Indonesia. Construction works are under way to widen and to pave the existing narrow strip leading to Likupang.

Transportation development

9. The road network in the province has improved significantly since 1970. The Trans-Sulawesi Highway extends from South Sulawesi to Bitung, and links most districts along the peninsula. This road stretches 2,000 km, of which 800 km pass through North Sulawesi province.

10. A runway of Dr. Sam Ratulangi airport, Manado, will be extended to 3,000 m from the existing 2,500 m in order to improve its function as an international airport. Cargo planes come from Davao twice a week, from Saipan five times a week, and from Singapore twice a week.

11. Perkins Shipping line, which is operating Darwin - Kupang - Singapore- Hong Kong sea line, will open a new shipping service of Darwin - Delli - Kendari - Bitung - Davao - Manila.

Long-term development plan of Bitung municipality

12. Municipality of Bitung has publicized its long-term development plan targeted for 1999. According to this plan, Lembeh island should be developed for the need of future port expansion, especially for stocking bulky cargoes and transshipment cargoes. A study on a bridge to connect Lembeh island with the main land will commence in 1994 with foreign assistance. If construction of the bridge is realized, future space for Bitung port expansion will be greatly facilitated.

A new economic zone concept

13. One of North Sulawesi's greatest assets is its potential 'Gateway' location. North Sulawesi is located at the Pacific rim where economic activities are flourishing like nowhere else in the world.

14. A new economic zone concept has been proposed. "Triangle Zone of Economic Growth in East ASEAN" involves three islands of four nations, which are Mindanao Island in the Philippines, Sulawesi Island in Indonesia, Borneo Island which is shared by Indonesia, Malaysia and Brunei.

15. Forty million people live in this zone, and this economic zone concept aims at achieving economic growth in the whole triangle zone by mutually combining natural, agricultural, fishery, and human resources as well as social infrastructures in the zone. North Sulawesi is expected to play vital roles in this concept.

Development potential and port

16. As mentioned above, North Sulawesi Province is expected to play leading roles as a development center in the northern part of Eastern Indonesia through utilizing its rich national resources and locational advantages. Industrialization should be promoted to pursue this goal, and Kabima industrial zone will gradually but steadily be activated centering around agro-industry or light industry.

17. More port traffic, especially container traffic, will be generated with the increase of economic activities in the hinterland where an annual economic growth rate of at least 7% is expected. Thus, improvement of infrastructures and strengthening of the gateway function of Bitung port is a must to achieve the regional economic development.

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 port tonnage traffic and passenger.

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 Bitung.

Hinterland : North Sulawesi, Central Sulawesi and North Maluku

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 North Sulawesi Province is 1.17 percent, that of Central Sulawesi Province is 2.26 percent and that of Maluku Province is 1.96 percent. As a result, the total population of the hinterland in 2000 is estimated to be about 7,176,000.

Economy

4. The economic growth rate is assumed at 7 % per annum in North Sulawesi, 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. Two methods will be used to forecast the commercial cargo volume handled at the port of Bitung. 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 major commodities and the other commodity groups individually.

C. Macro and Micro Forecast

6. Table 5-1 shows a summary of the forecast cargo, and Table 5-2 is a comparison of cargo volumes obtained by the macro and micro forecast methods.

Table 5-1 Result of Micro Forecast at Bitung Port

Unit : 1,000 ton						
Commodity	G.Cargo	Solid Bul	Liquid Bul	Bag Cargo	Drum	Total
1 Rice	0	0	0	107	0	107
2 Foodstuffs	0	0	0	197	0	197
3 Coconut Oil	0	0	35	0	0	35
4 Coconut Product	0	131	0	0	0	131
5 Agriculture	0	0	0	151	0	151
6 Fertilizer	0	0	0	22	0	22
7 Production Material	12	6	0	0	0	18
8 Wood	0	15	0	0	0	15
9 Asphalt	0	0	0	0	40	40
10 Cement and Material	0	287	0	16	0	283
11 Construction Material	0	126	0	0	0	126
12 Vehicle	0	59	0	0	0	59
13 Miscellaneous	935	0	0	0	0	935
Total	948	603	35	494	40	2,119

Table 5-2 Forecast of Total Cargo Volume in Target Year

Unit : ton	
	2000
Macro Method	1,675,000 - 2,214,000
Micro Method	2,119,000

7. Although there is a slight difference between macro and micro forecasts, the difference is negligible. Herein, the cargo volumes handled at Bitung Port for the target year will be forecast as those obtained by the micro forecast method.

E. Passenger

8. The number of passengers getting on and off at the port of Bitung can be estimated at 446,000 people.

F. Volume of Container Cargoes

9. 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.

10. Volume of container cargo forecast is shown in Table 5-3. The volume of container cargo in target year can be obtained from the general cargo by the package type.

Table 5-3 Percentage of Containerization at Bitung Port

	1989	1990	1991	1992	2000
Container Cargo (ton)	47,688	48,186	67,590	70,226	331,637
Containerizable Cargo (ton)	398,042	454,690	589,108	682,721	947,536
Percentage of Containerization	12%	11%	11%	10%	35%

Chapter 6 PORT FACILITY DEVELOPMENT PLAN

A. Basic Consideration for the Port Development

1. To formulate the short term development plan for the year of 2000, the following development policies are set;
 - (a) Bitung port should not be a hindrance to regional economic development
 - (b) Container handling capability of the Bitung port should be significantly improved
 - (c) Bitung port should be improved as the gateway port in the northern part of Eastern Indonesia.
2. Based on the above development policies, the following planning framework is agreed among DGSC, PERSERO IV, and JICA study team;
 - (a) Port of Manado will be closed and converted to a marina.
Existing function of Manado port will be moved to Likupang port
 - (b) Fishery boats at Bitung port will be moved to a new fishery port
 - (c) Cement packing plant will be constructed at the Interisland Wharf.

B. Present Capacity of the Port

Existing berth capacity

3. Capacity estimation of the existing berthing facilities is a necessary step for the determination of magnitude of additional berthing facilities to accommodate the anticipated traffic in 2000.
4. The optimum berth occupancy increases with the increase of the number of berths available. Considering the number of existing berths at the port of Bitung, the optimum berth occupancy at each wharf can be estimated at 65 % for the Oceangoing Wharf, and 70 % for the Interisland Wharf.
5. Analysis of ship call record and cargo handling documents of the port of Bitung for April 1993 reveals that ship productivity (BPI) was 31.9 ton/ship-hour for Oceangoing Wharf, and 2.8 ton/ship-hour for Interisland Wharf.
6. Based on the present ship productivity and gang productivity at the port of Bitung, the capacity of the existing berth under three shifts a day can be estimated as follows.

1,700 ton/m x 751 m =	1,276,700 ton/year	for Oceangoing Wharf
500 ton/m x 502 m =	251,000 ton/year	for Interisland Wharf
<hr/>		
Total	1,527,700 ton/year	

Existing storage capacity

7. Based on the information provided by Bitung branch office of PERSERO IV, standard capacity of the existing storage facilities are estimated at 957,000 ton/year for transit sheds and 687,000 ton/year for open storage area.

8. According to PERSERO IV, the port handled about 3,700 TEUs in 1991. An area of 4,000 m² has been designated as a container yard, and its standard capacity is estimated at less than 2,000 TEUs. Container handling at this port, however, has been conducted not only at the designated container yard but also at other open spaces. Therefore, the port has sufficient capacity for container handling.

C. Required Scale of the Port Facilities

Berthing facility

9. Considering both the forecast cargo volume and the capacity of the existing berthing facilities, cargo allotment by wharf in 2000 is summarized below;

	Year 1992	Existing Capacity	Year 2000
Oceangoing	848,339	1,276,700	1,300,000
Interisland	155,817	251,000	260,000
Others	19,124		26,000
(Cement)			267,000
(Container)			266,000
Total	1,023,280	1,527,700	2,119,000 (ton)

10. In conclusion, a specialized berth for container traffic and a berth for bulk cement carriers should be built to accommodate the anticipated traffic in 2000.

11. Government vessels such as those for national defense, however, are not taken into consideration in the calculation of the capacity of the existing berths. Therefore, it is recommended that the government build a specialized berth for these kinds of vessels in order to avoid excess congestion of the commercial port of Bitung.

Storage facility

12. It is forecast that a total of 393,000 tons of dry cargoes, which is less than the capacity of the existing storage facilities at the port, will utilize the transit sheds in 2000. Therefore, an additional transit shed is not necessary in 2000.

13. Assuming that 25% of the cargo handled at the Oceangoing Wharf and the Interisland Wharf will pass through the open storage areas, same volume of cargoes as the case of the transit sheds will utilize the open storage in 2000. Therefore, an additional open storage is also not necessary in 2000.