Forestry

19. Utilization of forest should consider the conservation of natural potential, forest resources and environment in maintenance of the ecological system. The forest area in the North Sulawesi province is allocated to be 1,877,220 ha comprising 1,583,720 ha of permanent forest area and 293,500 ha of convertible production forest area. Annual forest product output by the production forest area of 950,000 ha can reach the volume of 456,000 m3, with standing stock minimum of 40 m3 per hectare for 35 years cycle.

Fishery

20. Based on the development program fishery gives first priority to a phased modernization of activities by phase, off-shore fish catching, intensification, extensification and diversification.

Mining and Energy

21. The results of survey and exploration conducted on mineral resources potential in the North Sulawesi province are as follows:

a) Gorontalo Regency	----- Copper, Alluvial gold, Primary gold
b) Bolaang Mongondow Regency	----- Titano-magnetic iron sand
c) Minahasa Regency	----- Raw material for cement, Tras, Kaolin, Sulfur, Limestones, Construction material, Toseki

Manufacturing

22. The major manufacturing industry is coconut oil product, canned fish and processed wood. These factories are at a small scale, but they are very important to this province's economy. Furthermore this province already has an industrial area for future industrial development.

E. Infrastructure

Road

23. The Indonesian road network system is composed of state, regional, and regency/municipal roads. Table 1-4 shows the existing road length in the North Sulawesi province.

Table 1-4 Composition of Road in North Sulawesi in 1990

Kind of Road	Length (km)	Function/ Class	Length (km)	Construction	Length (km)	Condition	Length (km)
State	723.32						
		Artery	720.07	Asphalt	128.78	Smooth	no data
		Collector	3.25	Gravel	354.48	Not Smooth	no data
						Gravelled	no data
Regional	1,747.91						
		Artery	681.32	Asphalt	1,284.78	Smooth	622.61
		Collector	1,036.16	Gravel	754.48	Not Smooth	962.61
		Local	30.45	Earth	108.65	Critical	162.94
Regency/ municipal	4,397.93						
		Class I	-	Asphalt	1,887.20	Good	1,877.20
		Class II	-	Gravel	997.55	Average	1,006.55
		Class III	1,829.20	Unsurfaced	1,513.18	Damaged	633.75
		Class IV	395.05			Totally	
		Not Specified	1,590.63			damaged	389.38
Total	6,869.16		-		-		-

Source: Regional Investment Coordinating Board of North Sulawesi

Port

24. According to DGSC, the North Sulawesi province is reported to have 38 ports in total. Based on the DGSC data, there are three commercial ports, 35 non-comercial ports (9 mother ports and 26 working units). The composition of port in this province is shown in Table 1-5. On the other hand, this province has two ferry routes and one planned ferry route.

Table 1-5 Composition of Port in Norht Sulawesi

Commercial port									
	Bitung	Manado	Gorontalo						
Non-commercial port									
Mother port	Lirung	Tahuna	Ulu Siau	Belang	Kotabunan	Labuan Uki	Kwandang	Tilamuta	Likupang
Working unit	Miangas Karatung Esang Beo Rainis Melanguane Mangarang Marompit	Marore Petta Tamako Kawaluso	Pehe Tagulandang	Tumbak Amurang Air Tembaga	Molibagu	Inobonto Boroko	Tolinggula Gentuma	Rumbulan/ Tabulo Popayato Lemito	Kema

Source: DGSC

Airport

25. Air transportation expands the limited transport capacity in the regions through promoting the mobility of goods, services and people. It has greater involvement in socio-economic activities between regencies and provinces of the country. The province has four airports viz., Jallaludin (Gorontalo regency), Naha and Melanuance (Sangihe Talaud regency) and Sam Ratulangi (Manado municipality). Sam Ratulangi is the main airport in this province. The aircraft operation and passenger traffic is shown in Table 1-6.

Table 1-6 Number of Aircraft and Passenger Traffic at Sam Ratulangi Airport Manado

	1984	1985	1986	1987	1988	1989	1990	1991
Aircraft								
Departure	3,880	3,534	3,744	3,750	3,684	3,552	3,331	3,357
Arrival	3,861	3,558	3,722	3,650	3,678	3,570	3,333	3,368
Passenger								
Departure	81,448	78,810	77,717	83,722	90,230	102,664	98,958	102,702
Arrival	79,043	76,767	80,003	81,283	92,652	105,579	98,974	102,723
Transit	5,001	3,502	4,281	8,660	5,470	3,504	2,761	1,990

Source: KANTOR STATISTIK PROPISI SULAWESI UTARA

Chapter 2 PRESENT SITUATION OF THE PORT OF BITUNG

A. Municipality of Bitung

General

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 land 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.

2. This province is composed of Sulawesi Main Island and Lembeh Island. Between these two islands there is a strait named Lembeh (1 to 2 km in width and about 23 km in length running from northeast to southwest). The main area of this province, a very narrow flat land, belongs to Sulawesi Main Island. On the other hand, Lembeh Island is a narrow island 1 to 5 km in width and approximately 23 km in length; hills with an altitude of about 200 to 450 m run through the middle of the island.

3. The climate in this area is tropical with high temperatures and high humidity. Also the mountains run in all directions in Sulawesi creating a complicated topography so that the weather greatly differs depending on the locality. The climate in the peninsula North Sulawesi is generally characterized by much rainfall and the monsoon blowing in the northeast direction from December to March; there is less rainfall during the southeast monsoon from June to September.

Land use

4. The present land use of this municipality is shown in Table 2-1. According to this Table, about one third of this area is used for wood and most of the remainder is used for agriculture.

Table 2-1 Present Land Use in Bitung Municipality

Utilization	Area (ha)	Share (%)
Residence	1,379	4.54
Rice field	98	0.32
Dry field	3,301	10.86
Farming	5,754	18.92
Miscellaneous farming	8,061	26.52
Wood	10,291	35.92
Bushes/Grasses	641	2.11
Lake/Pond	75	0.25
Critical land	170	0.56
Miscellaneus	-	-
Total	30,400	100.00

Source: The Bitung National Land Concern Body

Port related industries

5. 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 as follows:

a) Pertamina (Oil industry)
b) Canning industry
c) Coconut oil industry
d) Shipbuilding industry

a) Pertamina (Oil industry)

6. Pertamina Bitung has two jetties and storage tanks at the west side of the port. This oil base is the oil supply base for North Sulawesi, Central Sulawesi and the northern part of Maluku.

b) Canning industry

7. Bitung is the main marine fishing center in the North Sulawesi province. Therefore, fishery production is one of the most important export commodities and has contributed to the economy in this area. Major commodities are fresh tuna, fresh skipjack, fresh shark, canned fish, etc..

8. To sustain the export, there are three canning factories (P.T. Union Pasific Food, P.T. Estadha and P.T. Deho) in this municipality. The export volume of canned fish in 1989 amounted to 1,476.94 tons with a value of US$ 2,877,000, while in 1990 it decreased to 787.64 tons with a value of US$ 1,446,000.

c) Coconut oil industry

9. Processing of copra is the most important industry in this municipality. The largest processing plant is P.T. Bimoli, which is located in Bitung. The plant is processing about 100,000 tons of copra annually. Each ton of coconut yields 60 % copra and each ton of copra yields 64 % coconut oil and 36 % feed pellets. P.T. Bimoli has its own storage tank for coconut oil at the port of Bitung. The oil is pumped into the tanks of interisland vessels. Feed pellets are the most important export cargo at this port.

10. The export volume of coconut oil in 1991 amounted to 54,433 tons with a value of US$ 17,332,570 and in 1992 it increased to 89,024 tons with a value of US$ 55,657,464. It is expected that the export will increase more in future.

d) Shipbuilding industry

11. There are two shipyards in Bitung municipality. One is P.T. Industrial Kapal Indonesia (IKI) Bitung, and the other is P.T. GALA KARYA Bitung. P.T. Industrial Kapal Indonesia Bitung has two building berths with capacity 135 BRT for new shipbuilding, three slipways with capacity 270 BRT for ship repairing and one slipway with capacity 200 BRT for ship repairing. On the other hand, P.T. GALA KARYA Bitung has one building berth with capacity 670 BRT for new shipbuilding and one slipway with capacity 1,000 BRT for ship repairing. Their main activities are almost exclusively for ship repairing.

B. Shipping Routes

General

12. The North Sulawesi province is the most important place for sea transportation and is connected to the inside of the province, other provinces and foreign countries by ship. The Bitung municipality has some ports, i.e. the port of Bitung (sea port), Bitung ferry terminal, fishing port, some private port. Therefore, there are some kinds of shipping routes in this municipality.

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

International shipping routes

14. The port of Bitung is located near Philippines. 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)". The other routes are " Bitung - Taiwan route" and " Bitung - Singapore route".

Pelni passenger

15. Pelni passenger ships call at the port of Bitung. The following shipping routes are operating in 1993 (see Figure 2-1);

a) Ambon -> Bitung -> Ternate -> Ambon -> Bau-Bau -> Uj.Pandang -> Surabaya -> Tj.Priok -> Belawan -> Tj.Priok -> Surabaya -> Uj.Pandang -> Bau-Bau (Ship name: KM.KERINCI)

b) Belawan -> Tj.Priok -> Surabaya -> Uj.Pandang -> Balikpapan -> Pantoloan -> Toli-Toli -> Bitung -> Toli-Toli -> Pantoloan -> Balikpapan -> Uj.Pandang -> Surabaya -> Tj.Priok (Ship name: KM.KAMBUNA)

c) Manokwari -> Jayapura -> Manokwari -> Sorong -> Ternate -> Bitung -> Kwandang -> Uj.Pandang -> Tj.Priok -> Uj.Pandang -> Kwandang -> Bitung -> Ternate -> Sorong (Ship name: KM.UMSINI)

d) Balikpapan -> Toli-Toli -> Tarakan -> Nunukan -> Toli-Toli -> Balikpapan -> Pare-Pare -> Batulicin -> Surabaya -> Benoa -> Bima -> Uj.Pandang -> Kendari -> Kolonedale -> Luwuk -> Gorontalo -> Bitung (Ship name: KM.AWU)

e) Tahuna -> Bitung -> Gorontalo -> Luwuk -> Kolonedale -> Kendari -> Uj.Pandang -> Bima -> Benoa -> Surabaya -> Kumai -> Semarang -> Kumai -> Surabaya -> Batulicin -> Pare-Pare (Ship name: KM.AWU)

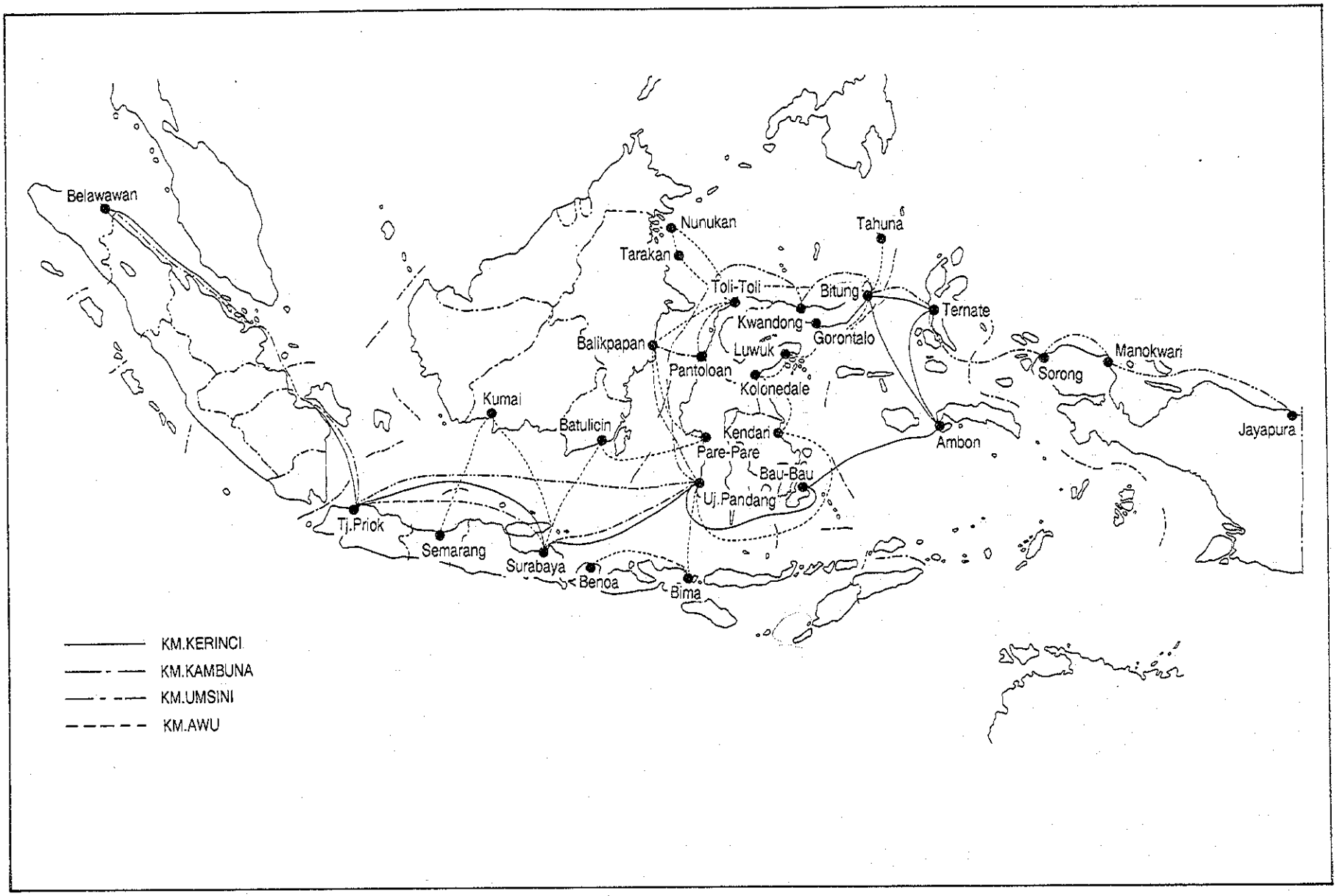


Figure 2-1 Pelni Passenger Shipping Routes

Perintis

16. The port of Bitung is one of the base ports at which the Perintis lines call. In 1993 the following shipping routes are operating;

a) Bitung -> Tahuna -> Mangarang -> Lirung -> Beo -> Esang -> Geme -> Karatung -> Miangas -> Marore -> Kawaluso -> Tahuna -> Bitung
b) Bitung -> Tahuna -> Kawaluso -> Marore -> Miangas -> Karatung -> Geme -> Esang -> Beo -> Lirung -> Mangarang -> Tahuna -> Bitung
c) Uj.Pandang -> Kendari -> Kolonedale -> Luwuk/Banggai -> Posso -> Parigi -> Gorontalo -> Bitung
d) Ternate -> Mayao -> Tifure -> Bitung

Container

17. The port of Bitung has been handling container cargoes. International container shipping routes are also in operation. For example, liner container service between Bitung port and General Santos port in the Philippines has been operating. A semi-container vessel with capacity of 28 TEUs is servicing on this route. The main commodity of this route is canned fish. The rest of container shipping routes have transshipment ports at Surabaya and Jakarta.

Ferry

18. Ferry operation between Bitung and Ternate started 6 May 1993. The outline of Bitung ferry terminal is shown in Table 2-2. This ferry route was operated from 16 May 1993 to the end of June 1993 and stopped operation from 1 July 1993 to the middle of September 1993. The fare of this ferry service is higher than that of Pelni route in spite of the shorter distance, and this ferry vessel has no rest space. Therefore, this vessel underwent renovation and resumed operation from the middle of September 1993. There is no other ferry service from Bitung, but another ferry service is planned. In 1994, Bitung will be connected with Pananaro.

Table 2-2 Bitung Ferry Terminal

Facility	Dimension
Jetty	20 tons (Water depth: -7 m)
Movable bridge	15 tons
Parking area	2,000 m2
Passenger terminal	428 m2
Ferry boat	Ship size: 500 GRT
	Capacity : Vehicle 8 cars Passenger 60 persons
	Route: Bitung - Ternate
	Service: 3 trips/week

Source: KANWILL NORTH SULAWESI

C. Port Facilities

Port limits

19. The port limits of Bitung are as follows:

a) Land area ----- 45.0 ha
b) Water area ----- 85.7 ha

20. Above areas are managed by Persero and are used publicly. But some places in above area are rented to private company. (see Figure 2-2)

Berthing facilities

21. The berthing facilities at the port of Bitung are managed by Persero, DGLT and private companies. The public wharves (Oceangoing, Chemical, Interisland and Local wharf) are managed by Persero.

22. The berthing facilities at the port of Bitung are functionally classified as shown below.

a) Oceangoing Wharf

The oceangoing wharf (length: 605 m, water depth: -9.0 m) is the main berth of this port and is used by oceangoing vessels and interisland vessels. This wharf consists of reinforced concrete deck on concrete piles.

b) Chemical Based Industry Wharf

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.

c) Interisland Wharf

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.

d) Local Wharf

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

e) Other berthing facilities

The ferry jetty managed by DGLT is located on the east side of this port. One dolphin for oil tankers and concrete piers for loading small tankers exist on the west side of this port. They belong to Pertamina and handle oil only.

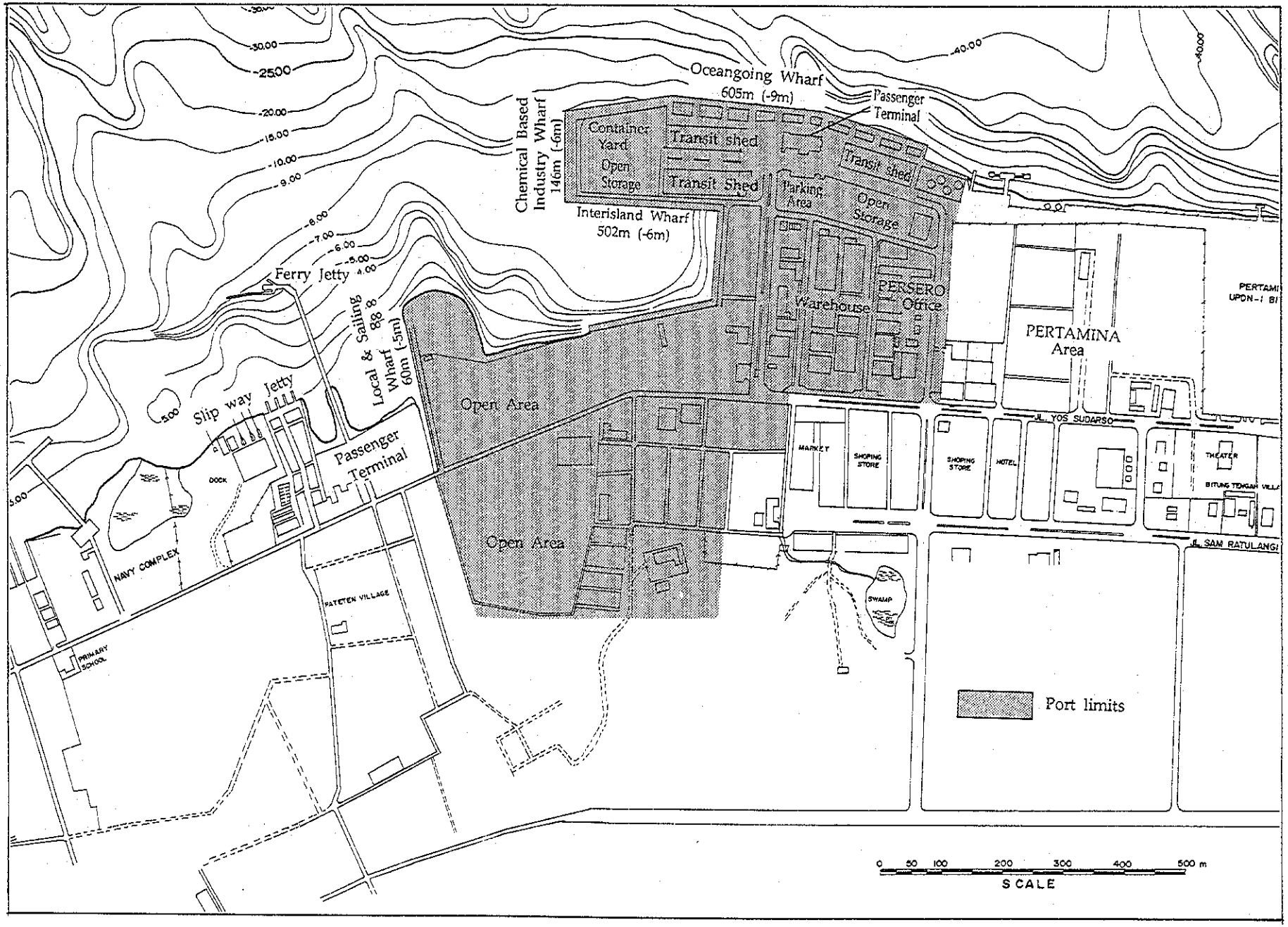


Figure 2-2 Existing Facilities of Bitung Port

Storage facilities

23. There is 12,960 m2 of transit sheds behind the oceangoing wharf. These sheds are managed by Persero. This port also has 22,548 m2 of warehouses at the center of this port land area. These warehouses are used by the private company. On the other hand there are 15,500 m2 of open storage areas and 4,000 m2 of container yard.

D. Cargo and Passenger Traffic through the Port

Cargo handling volume

24. Table 2-3 and Figure 2-3 show cargo volume handled at the public wharves of the port of Bitung from 1984 to 1992. Cargoes handled at both Pertamina's jetty and loading point are excluded from both the table and the figure.

25. A total of 1,176,794 tons of cargo was handled at this port in 1992; 28,845 tons for import, 96,243 tons for export, and 876,844 tons for domestic unloading, and 174,862 tons for domestic loading. Thus, the domestic unloading is by far the largest category, and accounted for three quarters of the total cargo volume in 1992.

26. Total volume of public cargo has been increasing at an 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%, respectively, while international cargo volume has been fluctuating year by year, reflecting prices of primary commodities at international markets.

27. Table 2-4 shows commodity-wise cargo volume handled during the same period. Miscellaneous goods have been the main component (506,102 tons, 43% in 1992), followed by construction materials (219,880 tons, 19%), agricultural products (202,577 tons, 17%), and foodstuffs (183,921 tons, 16%).

28. Main commodities of import at the port of Bitung have been foodstuffs and construction materials. North Sulawesi province has been a rice deficit province. On the other hand, main commodities of export have been agriculture products such as coconut oil and copra.

29. Table 2-5 shows packing type of cargo at the port of Bitung. 547,527 tons, which accounted for 47% of the 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 the total, and main commodities of this packing type include cement and foodstuffs. Containers were handled at the port before 1984. Volume of the containerized cargo at Bitung was 70,226 tons in 1992. Exporting container cargoes include canned fish.

Table 2-3 Port Tonnage Traffic through Port of Bitung

Unit : ton

Year	Foreign Trade		Domestic Trade		Total
	Import	Export	Unloading	Loading	
1984	27,177	33,564	485,895	96,051	642,687
1985	11,633	135,007	537,516	96,415	780,571
1986	37,639	81,726	505,693	76,176	701,234
1987	32,131	79,832	628,127	166,455	906,545
1988	8,589	89,579	639,835	195,185	933,188
1989	25,503	74,264	666,158	174,076	940,001
1990	11,725	112,521	716,716	210,156	1,051,118
1991	19,319	93,646	818,920	119,575	1,051,460
1992	28,845	96,243	876,844	174,862	1,176,794
A.G.R.(%)	0.75	14.07	7.66	7.78	7.85

Source : PERSERO of Bitung, Modified by JICA Sturdy
Remark : A.G.R. Anual Growth Rate (%) '84-'92
These data are shown Port Tonnage Traffic of Public Wharves.

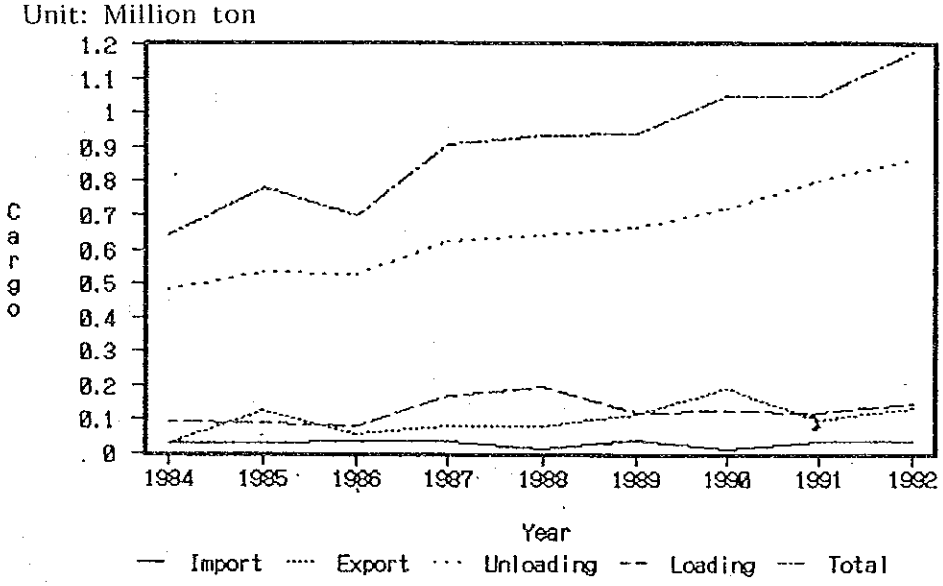


Figure 2-3 Cargo Volume at Bitung Port

Table 2-4 Commodity-wise Cargo Volume at Bitung Port

Unit : ton

No	Commodity Group	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	Foodstuffs	155,959	124,233	75,966	118,919	150,042	160,246	174,283	156,639	183,921
2	Agricultual Productions	79,728	208,728	155,590	172,144	211,093	182,249	212,428	210,323	202,577
3	Construction Materials	164,151	135,016	133,437	153,543	155,350	168,410	187,723	191,781	219,880
4	Production Materials	11,480	35,099	16,730	21,656	27,081	24,024	28,127	22,338	27,790
5	Vehicle	24,636	25,727	11,641	24,130	94,769	35,227	43,463	12,293	36,524
6	Miscellaneous	206,813	250,768	307,870	416,145	294,853	369,851	405,095	458,087	506,102
	Total	642,687	780,571	701,234	906,545	933,188	940,001	1,051,118	1,051,460	1,176,794

Source : PERSERO of Bitung, Modified by JICA Study Team

Table 2-5 Package Type of at Bitung Port

Unit : ton

	1984	1985	1986	1987	1988	1989	1990	1991	1992
General cargo	255,966	351,436	321,540	486,861	413,849	303,358	354,601	462,340	547,527
Unitized	24,651	12,954	14,001	24,133	28,400	40,737	47,590	55,498	64,968
RoI	683	724	822	629	4,194	6,259	4,313	3,680	
Solid Bulk	38,933	101,594	79,886	83,146	60,426	85,073	89,625	85,836	69,209
Liquid Bulk	8,838	29,082			29,540	89,683	146,740		52,215
Bag Cargo	289,939	259,450	254,999	285,368	356,580	364,216	338,852	352,464	372,649
Drum	14,835	15,182	18,856	5,116	4,283	22,987	21,211	24,052	
Container	8,850	10,149	11,130	21,294	35,916	47,688	48,186	67,590	70,226
Total	842,687	780,571	701,234	906,545	933,188	940,001	1,051,118	1,051,460	1,176,794

Source : PERSERO of Bitung

Trading partners of domestic cargoes

30. Table 2-6 is the summary result of the ship call record of the Bitung port in October 1992. The ship call record contains information on "the first port of call out", "the last port of call in", and volume of cargo loaded and unloaded at the port of Bitung. The ship call record does not reveal true origins and destinations of cargo, but shows the outline of the cargo movement.

31. It can be estimated that the majority of cargoes, especially consumer goods, come 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 outgoing cargoes are destined for Maluku province; Ternate is one of the major destination points of the outgoing cargoes.

Table 2-6 Cargo Movement at Bitung Port

Bitung			
Unloaded Last port	Share (%)	Loaded Next Port	Share (%)
E.JAWA	35	Jakarta	39
S.Sulawesi	30	Maluku	32
Jakarta	29	E.Jawa	15
N.Sulawesi	3	N.Sulawesi	6
Others	2	Others	9

Remarks: Pertamina cargo is excluded.
Source: Ship Call Records, Bitung 10/'92

Passenger traffic

32. Passenger traffic by embarkation and disembarkation at the port over the last nine years is shown in Table 2-7. The total passenger traffic increased steadily during 1984 - 1992. The average annual growth rate was more than 12% during the said period.

33. Number of passenger in 1992 was 198,209, which was the largest ever recorded at the port of Bitung. Four Pelni passenger ships "KM. AWU", "KM. KERINCI", "KM. UMSINI", and "KM. KAMBUNA" make calls to the port twice a month each. It is likely that number of sea passengers will increase as per capita income in the region increases and better shipping services to users are offered.

34. In May 1993 a ferry service between Bitung and Ternate commenced. The ferry service is available three times a week for one way. It is reported that a new ferry service connecting Bitung and Sangihe island will commence from December 1993. Traffic data of the ferry service have not been available so far.

35. According to Kanwil of Ministry of Communications and Tourism, cruising vessels have been calling the port of Bitung from Sydney and Brisbane, Australia. As tourism development projects are in progress in North Sulawesi province, especially in the northern part of the province, more cruise passengers are expected to arrive at the Bitung port in future.

Table 2-7 Disembarked and Embarked Passenger at Port of Bitung

Unit : Person

Year	Disembarked	Embarked	Total
1984	39,775	39,234	79,009
1985	59,917	60,871	120,788
1986	67,876	72,932	140,808
1987	71,362	74,085	145,447
1988	80,736	81,050	161,786
1989	90,721	87,257	177,978
1990	83,299	91,804	175,103
1991	93,753	90,782	184,535
1992	99,837	98,372	198,209
A.G.R.(%)	12.19	12.18	12.18

Source : PERSERO of Bitung
Remarks : A.G.R. Annual Growth Rate (%) '84-'92

E. Calling Vessels

36. Number of shipcall by shipping type can be seen in Table 2-8. 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.

37. Number of calling ships increased from 1984 to 1990 with an annual growth rate of 11.5%. Over the last three years, however, number of calling ships to the Bitung port has been rather stable, i.e., 2,675 calls in 1990, 2,635 calls in 1991, and 2632 calls in 1992.

38. Breaking down by shipping type, Local/Rakyat made 1,046 calls (40%), followed by Oceangoing vessels with 747 calls (28%), and Interinsular vessels with 572 calls (22%).

39. In terms of Gross Registered Tonnage of the calling vessels, a total of 3,720,310 GRT was recorded at the Bitung port in 1992, and showed an annual growth rate of 13.68% from 1984 to 1992.

40. Breaking down by shipping types, a total GRT of the Interinsular vessels was 1,903,447 GRT (51%), followed by Special shipping of 856,827 GRT (23%), Oceangoing vessels of 842,921 GRT (23%), and Local/Rakyat of 117,115 GRT (3%).

41. Average vessel size by shipping type in 1992 can be calculated as follows;

Shipping type	Av. GRT
Ocean going	1,128
Interinsular	3,328
Local/Rakyat	112
Special	3,209
Total	1,413

42. The table above may be misleading because it shows that the average GRT of Interinsular vessels is about three times larger than that of Oceangoing vessels. It will be required to make clear how the statistics on calling ships have been dealing with fishery boats which have been mooring along the chemical berth and a part of the Interinsular berths.

Table 2-8 Ship Call at Bitung Port, 1984-1992

Year	Ocean		Interinsular		Lokal/Rakyat		Special		Total	
	Call	GRT	Call	GRT	Call	GRT	Call	GRT	Call	GRT
1984	35	174,841	398	715,844	673	42,268	283	401,712	1,389	1,333,865
1985	86	711,838	415	1,287,555	874	84,946	250	412,218	1,625	2,496,549
1986	58	460,413	393	1,313,619	967	78,518	241	503,976	1,659	2,356,526
1987	66	550,452	465	1,372,925	1,059	73,682	274	686,973	1,864	2,684,032
1988	70	627,429	462	1,345,675	1,248	81,374	301	745,447	2,081	2,799,925
1989	211	551,046	421	1,358,011	1,268	102,461	269	709,822	2,169	2,720,540
1990	459	521,048	540	1,511,479	1,416	105,011	260	716,773	2,675	2,854,311
1991	501	649,042	594	1,827,691	1,328	197,304	212	761,175	2,635	3,435,212
1992	747	842,921	572	1,903,447	1,046	117,115	267	856,827	2,632	3,720,310
A.G.R.(%)	46.61	21.73	4.64	13.02	5.67	13.59	-0.72	9.93	8.32	13.68

Source : PERSERO of Kupang
Remarks : A.G.R. Annual Growth Rate (%) '84-'92

F. Facility Utilization

Berthing facilities

43. In general, the utilization level of the berthing facilities is evaluated by the following indicators.

a) Berth occupancy ratio (BOR)
b) Berth throughput (BTP)

44. Above indicators are already calculated by PERSERO IV. The historical development of indicator "BOR" is shown in Table 2-9. According to this Table, the average BOR of all berthing facilities at this port steadily increased from 1984 to 1992. Among four kinds of wharves which the port of Bitung has, the oceangoing wharf, which is the main wharf at this port, has the lowest BOR.

Table 2-9 Berth Occupancy Ratio at Bitung

Unit: %

Year	Oceangoing Wharf	Interisland Wharf	Chemical Wharf	Local Wharf	Total
1984	n.a	n.a	n.a	n.a	36
1985	n.a	n.a	n.a	n.a	32
1986	n.a	n.a	n.a	n.a	21
1987	n.a	n.a	n.a	n.a	25
1988	n.a	n.a	n.a	n.a	35
1989	n.a	n.a	n.a	n.a	40
1990	n.a	n.a	n.a	n.a	48
1991	51	75	73	100	63
1992	55	72	57	90	64

Note: n.a means not available.
Source: PERSERO IV

45. The historical development of indicator "BTP" is shown in Table 2-10. According to this Table, there was an upward trend regarding the average BTP of all berthing facilities at this port. Furthermore, the BTP at the oceangoing wharf is over 1,200 tons/m in 1992. But the BTP at interisland wharf and local wharf is about 300 tons/m. It seems that the average BTP at this port depended on the BTP at oceangoing wharf.

Table 2-10 Berth Throughput at Bitung

Unit: Tons/m

Year	Oceangoing Wharf	Interisland Wharf	Chemical Wharf	Local Wharf	Total
1984	n.a	n.a	n.a	n.a	387
1985	n.a	n.a	n.a	n.a	600
1986	n.a	n.a	n.a	n.a	615
1987	n.a	n.a	n.a	n.a	568
1988	n.a	n.a	n.a	n.a	617
1989	n.a	n.a	n.a	n.a	634
1990	n.a	n.a	n.a	n.a	707
1991	1,121	555	340	268	808
1992	1,270	310	549	319	784

Note: n.a means not available.
Source: PERSERO IV

46. There is distinguished characteristics regarding the relationship between BOR and BTP at each wharf of this port. For example, the BOR at oceangoing wharf is the lowest value, but the BTP at this wharf is the highest value. On the other hand, the BOR at other three wharves are high values, but the BTP are low values. Thus, the BOR is inversely proportional to the BTP at this port.

Storage facilities

47. In Indonesia, the utilization level of the storage facilities is evaluated by the following indicators.

a) Shed occupancy ratio (SOR)
b) Shed throughput (STP)
c) Open storage occupancy ratio (OSOR)
d) Open storage throughput (OSTP)

48. Above indicators are also calculated by Persero IV. The historical development of indicator "SOR", "STP", "OSOR" and "OSTP" is shown in Table 2-11.
According to this Table, the following tendency is found.

a) There were fluctuations regarding SOR and STP.
b) There was an upward trend regarding OSOR and OSTP.

Table 2-11 Utilization of Storage Facilities at Bitung

Year	SOR (%)	STP (Tons/m2)	OSOR (%)	OSTP (Tons/m2)
1984	8	23	1	5
1985	7	26	2	3
1986	6	19	2	9
1987	13	37	1	4
1988	12	39	3	12
1989	5	31	3	26
1990	6	36	4	24
1991	6	28	4	27
1992	7	29	5	28

Source: PERSERO IV

G. Port management and operation

Organization

49. 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.

50. Organization charts and number of personnel for PERSERO office and ADPEL office in Bitung port are as shown in Appendix 2-1 and 2-2.

Port service

51. In port of Bitung, following port service is provided by PERSERO and so on.

1) Berth allocation and overall coordination

52. Berth is allocated to ships by PERSERO office based on "First come First serve" principle, though priority is given to passenger ships, rice ships and PERINITS. Also a meeting within PERSERO (known as P2JP) is held every day to harmonize the various port services. Coordination meeting chaired by ADPEL is held once a month to evaluate and arrange port operational affairs, and is attended by other governmental agencies such as customs, immigration, security, quarantine as well as cargo handling companies and PERSERO office.

2) Pilotage and towing service

53. Service vessels currently used at the port of Bitung are listed in the following table.

Table 2-12 List of Service Vessels

Name	Capacity	Quantity	Year of construction	Number of crews including captain
Pilot boat	300HP	1	1977	3
Pilot boat	150HP	1	1982	2
Tug boat	1,160HP	1	1977	6
Tug boat	800HP	1	1987	6

Source: PERSERO Bitung port office

54. The 24 hours of pilotage is offered by turns by four teams of pilotage division of PERSERO office using not only two units of pilot boat but also two units of tug boat. As for towing service, 24 hour service is available by two teams of PERSERO office. Use of these service for 1987 to 1991 is as shown in Table 2-13.

Table 2-13 Use of pilotage and Towing Service

	1987	1988	1989	1990	1991
Pilotage(number of sail)	2,190	2,077	2,654	2,331	2,335
Towing (h)	990	845	902	961	1,178

Source: PERSERO Bitung port office

3) Water supply service

55. Water has been supplied by two systems, namely by pipe from PDAM (stateowned water supply company) and by transportation of barges with capacity of 200 tons. As for the former system, there are seven water supply taps at OCEANGOING wharf and INTERISLAND wharf and the capacity per tap is 125 t/h. PERSERO buys original water at unit price of Rp 2,775/ton from PDAM and supplies vessels at unit price of Rp 4,500/ton. Water volume provided from 1987 to 1991 is as shown in Table 2-14.

Table 2-14 Supplied Water Volume (1987-1991)

	1987	1988	1989	1990	1991
Supplied water volume(ton)	91,227	92,333	83,250	96,960	98,413

Source: PERSERO Bitung port office

4) Oil supply service

56. Oil has been supplied through three oil supply taps only at OCEANGOING wharf by PERTAMINA. At present there are no oil supply taps besides this wharf which creates an inconvenient situation.

Port labor and cargo handling

1) Port labor supply system

57. 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, of which 1,200 is for cargo handling and 311 is for forwarding. Port labor is supplied by a port labor cooperative organization known as KOPERASI TKBM which is responsible for organizing gangs and allocation of port labor to cargo handling companies under control of ADPEL. In Bitung port, port labor is allocated not on a daily basis but on a vessel basis, that is, port labor is not changed until after the completion of cargo handling of one vessel. Also wages for port labor are not fixed on a daily basis, but they work on a pace rate according to productivity.

58. Most port labors work 15 days per month on average, and daily wage ranges approximately from Rp 4,500 for unskilled labor to Rp 6000 for skilled labor. Also cargo handling is conducted approximately 320 days per year and for the rest of 45 days it is not conducted due to the special national holidays and nasty weather days.

59. Port labors usually work two shifts a day in the port of Bitung but a third shift is available in case of request from users.

Ordinal shift	8:00 - 16:00	(12:00-13:00 break time)
	17:00 - 22:00	(20:00-21:00 break time)
Extra shift	22:00 - 6:00	(2:00-3:00 break time)

60. The gang organization for cargo handling is as follows:

(i) Stevedoring per gang

Head labor	1	
Winch driver/pilot	3	
Labor	8	
Total	12	persons

(ii) Cargodoring per gang

Head labor	2	
Labor	22	
Total	24	persons

(iii)Delivery/Receiving per gang

Head labor	1	
Labor	11	
Total	12	persons

2) Cargo handling equipment

61. Table 2-15 outlines the equipment in the port of Bitung. At the OCEANGOING wharf, cargo handling is conducted for oceangoing and interinsular vessels. Also at the INTERISLAND wharf, cargo handling is conducted for the interinsular vessels. This stevedoring is conducted by the derrick crane on the ship and a mobile crane. Carriage of the cargoes to the transit sheds, warehouses and open storages is performed by manpower, carts, forklifts and trucks. Equipment owned by PERSERO office includes two mobile cranes (having a suspending capacity of 15 tons and 25 tons) and six forklifts (2-5 tons), though three of them are seriously damaged.

Table 2-15 List of Cargo Handling Equipments in the Port of Bitung

Kind	Capacity	Number	Ownership	
			PERSERO	Private
Mobile Crane	15 Ton	1	1	-
	25 Ton	1	1	-
	Total	2	2	-
Forklift	2 Ton	3	3	-
	2.5 Ton	3	-	3
	3 Ton	2	2	-
	5 Ton	4	1	3
	Total	12	6	6

Source: PERSERO Bitung port office

3) Cargo handling productivity

62. The hourly cargo handling productivity per gang by cargo type is as follows.

Cargo type	Handling Productivity
General cargo	15-18 ton/g/h
Bagged cargo	19-24 ton/g/h
Chip of copra	30-40 ton/g/h
Palletized cargo	18-22 ton/g/h
Liquid cargo in drum	17 ton/g/h

Customs procedure

63. In Indonesia, customs inspection of exports and interisland shipments was abolished. In the case of import consignments worth more than US$ 5,000, the authority to inspect was transferred from the Department of Customs to the contracted surveying firm which conducts inspections at the overseas origin of the cargo by INPRES 4/1985.

64. In the port of Bitung, 97 % of total imported cargo was consignments worth more than US$ 5,000 in 1991. Therefore remainder of only 3% was inspected by customs office in Bitung port. The customs clearance procedure takes three or four hours on average in Bitung port.

Port tariff and cargo handling tariff

65. There are three categories of port tariff classified by the rank of port in Indonesia. The first and second categories apply to the ports of Tg.Priok, Tg.Perak, Belawan and Makasar. The third category applies to all other Indonesian ports including Bitung. The charge system of Bitung port is generally divided into charges for ships, charges for cargoes and other charges. Charges for ships and cargoes are stipulated by Minister of Communications, and other charges such as water supply, entrance fee, land, building and equipment rent and so on, are determined by the director of PERSERO IV. Current port tariff in Bitung port is shown as APPENDIX 2-3.

66. In Indonesia cargo handling charge is agreed upon by negotiation between association of cargo handling companies and that of users in each port. Current cargo handling tariff in the port of Bitung is shown as APPENDIX 2-4.
Also cargo handling companies can get 26% of the charges and the rest of them belongs to KOPERASI TKBM, part of which is used to pay wages of port labors.

Financial statements of PERSERO IV and port of Bitung

1) Financial statements of PERSERO IV

67. The PERSERO IV's balance sheets and profit and loss statements (1987-1991) are shown in Appendix 2-5. It can be generally said that when the calculated operating ratios are less than 70-75% and the working ratios are less than 50-60%, the operation is efficient. Operational efficiency has been improved substantially and working ratio and operating ratio in 1991 show that efficient financial conditions prevail at PERSERO IV.

68. In addition, current ratio shows the conditions of liquidity, and it is desirable that it is more than 150 %. The current ratio of PERSERO IV shows a very high value (above 600% in 1991) and it has not been necessary to obtain loans for working capital. From this view point one may say that liquidity of PERSERO IV has been very high level and it can furnish working capital easily to branch offices which run a deficit.

69. Profit and loss statements by service type of PERSERO IV (1991) are shown in Appendix 2-5. About 21% of the revenue is generated from main facilities charge (such as anchorage, mooring and quay charge), 12.5% from pilotage charge, 10.8% from harbor permit, 9.9% from towing charge, 6.4% from water supply charge, 5.1% from cargo handling charge.

2) Financial statements of port of Bitung

70. The balance sheets and profit and loss statements of PERSERO Bitung port office (1988-1991) are shown in Appendix 2-6. Operating ratio and working ratio have been improved, however, values are still at a fairly high level.
Also in 1991 it could make profit for the first time and working ratio in 1992 is 63.7%. In addition, comparing profit and loss statements of PERSERO IV with those of Bitung port, the latter has only small share in the former, namely 7.3% in revenue and 9.4% in expense. From this view point, one may say that the change in financial statements of Bitung port have only a slight influence on the overall financial statements of PERSERO IV.

71. Profit and loss statements by service type of Bitung office(1991) are shown in Appendix 2-6. About 28.9% of the revenue is generated from main facility charges, 17.4% from harbor permit, 14.9% from towing charges, 12.0% from water supply charges. Without taking account of general indirect costs, most port services are profitable except warehousing or equipment service.

H. Review of the Existing Plan

General

72. 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. The title of this master plan report was "WORLD BANK MARITIME LOAN III DEVELOPMENT PROGRAM MASTER PLAN, FEASIBILITY STUDY AND ENGINEERING DESIGN FOR THE PORTS OF BITUNG, MAKASSAR, LEMBAR AND KENDARI PACKAGE D".

73. The master plan was formulated by reviewing the existing master plan which was formulated by Japan International Cooperation Agency (JICA) study team in March 1978. The title of the master plan report in 1978 was "FEASIBILITY STUDY REPORT ON THE EXPANSION PROJECT OF THE BITUNG PORT". Therefore, it seems that it is important to review above existing master plan for this study.

Master plan in 1984

74. Since 1984 the port development at Bitung port has been based on this master plan. The outline of this master plan is as follows;

1) Demand forecast of port traffic

The results of demand forecast of port traffic are shown in Table 2-16.

Table 2-16 Demand Forecast of Port Tonnage Traffic

Unit: Tons

Year	Ocean Khusus	RLS/ Khusus	Local/ Sail	Total Dry cargo
2000	465,000	1,253,000	126,000	1,844,000

Source: Master plan report in 1984

2) Required port facilities

The required port facilities in 2000 are shown in Table 2-17.

Table 2-17 Required Port Facilities in 2000

Unit: m

Berth Types	No. of Berth	BOR (%)	Berth Length (Required)	Berth Length (Available)	Berth Length (Additional)
Container					
*Interisland	1	27	125	-	125
General Cargo					
*Ocean	3	55	570	582	-
*Interisland	7	69	640	455	185
Bulk					
*Cement	1	13	125	130	-
Sub-Total	12		1,460	1,167	310
Local vessel					
Sailing vessel			360	-	360
Total			1,820	1,167	670

Note: Assumption - Ocean and RLS services containerized
Source: Master plan report in 1984

75. The difference between above two master plans is containerization at this port. In 1978 containerization had not started at this port, but in 1984 container cargoes were already handled at this port. Therefore, this master plan puts emphasis on containerization. In future, it seems that it is very important to consider containerization regarding the port development.

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. The nearest observatory to Bitung observatory is located at Mapanget, Manado Airport.

Temperature and humidity

2. Table 3-1 shows the meteorological data obtained at Mapanget observatory, Manado. 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 recorded at Mapanget observatory is 2,716 mm as shown in Table 3-1. Low precipitation is observed in the dry season from July to October, and the lowest monthly mean precipitation falls to 87 mm in September. High precipitation is recorded in the rainy season from December to March, and the highest monthly mean precipitation reaches 478 mm 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 15 m/s in the afternoon mainly due to the superposition of sea freeze and monsoon as shown in Table 3-2 and Figure 3-1.

Cloud cover

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

Table 3-1 Meteorological Data in Manado (1°32°N., 124° 55°E.)

Height above Mean Water Level:1.5m

Data covering 10 to30 years from 1931 to 1960

Month	Mean Air Pressure at Mean Sea Water Level	Temparature					Mean Humidity			Mean Cloud Cover (One-Tenth Ratio)		Precipitation		Wind Derection 0800									Mean Wind Velo-city	No.of Windy days	No.of Foggy Days	No.of Thundery Days
		Daily Mean Max	Daily Mean Min	Monthly Mean Max	Monthly Mean Min	Monthly Mean	07:00	14:00	Monthly	Total	-	Mean	No.of days with rain fall of more than 1.0mm	N	NE	E	SE	S	SW	W	NW	Calm				
	mb	℃	℃	℃	℃	℃	%	%	%	-	-	mm	-	%	%	%	%	%	%	%	%	%	m/s			
Jan	1010	30	23	32	21	25.2	93	76	87	5	-	478	18	8	11	9	5	4	8	7	7	21	1.5	0	0	3
Feb	1010	29	23	32	21	24.6	93	75	87	5	-	357	16	10	9	6	4	2	6	18	19	23	2.1	0	0	5
Mar	1010	29	23	32	21	25.2	92	73	84	5	-	313	14	9	13	9	5	5	6	16	16	21	2.1	0	0	1
Apr	1009	30	23	32	22	25.8	92	74	82	5	-	202	12	8	12	9	8	6	6	14	15	22	1.5	0	0	4
May	1009	31	23	32	22	26.0	91	71	83	4	-	162	11	8	10	11	10	10	5	12	14	20	1.5	0	0	5
Jun	1008	31	23	32	22	25.6	90	69	77	4	-	166	10	9	10	11	9	12	5	12	13	19	2.1	0	0	2
Jul	1009	31	23	33	21	25.8	87	64	77	4	-	124	9	9	9	10	10	10	9	10	12	21	2.1	0	0	1
Aug	1009	32	23	34	21	26.2	85	60	74	3	-	104	8	7	7	10	12	20	7	9	10	18	1.5	0	0	3
Sep	1009	32	23	34	21	25.8	86	62	76	4	-	87	7	6	8	11	14	14	5	10	12	20	2.1	0	0	2
Oct	1009	32	23	33	21	26.2	89	66	79	4	-	125	9	5	8	9	8	9	6	11	16	27	1.5	0	0	3
Nov	1009	31	23	33	21	25.8	91	72	84	4	-	227	13	5	8	8	6	6	7	16	18	26	1.5	0	0	4
Dec	1008	30	23	32	22	25.9	92	74	85	5	-	371	16	7	10	7	4	4	8	18	19	23	2.1	0	0	2
Average	1009	31	23	x 34	xx 19	25.7	90	70	81	4	-	-	-	7	10	9	8	8	7	14	15	22	2.1	-	-	-
Total	-	-	-	-	-	-	-	-	-	-	-	2716	143	-	-	-	-	-	-	-	-	-	-	0	0	35
Extreme	-	-	-	x 36	xx 17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
No.of Years Recorded	30													10									10	30		

x Average of annual maximum temperature xx Average of annual minimum temperature + Maximum temparature recorded ++ Minimum temparature recorded

Table 3-2 Occurrence of Wind

Jan. to Dec.91(year)

Direction / Velocity(kt)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	Total	(%)		
-4.99	49	199	137	127	100	66	56	57	116	460	614	241	41	19	10	38	2330	-26.9		
5.00-9.99	52	214	134	150	53	27	14	64	189	438	230	56	3	3	2	39	1668	-19.2	Total	8760
10.00-14.99	70	293	142	110	31	3	13	122	317	286	61	19	2	·	·	36	1505	-17.4	Observed	8675
15.00-19.99	28	146	33	28	8	·	·	107	135	38	2	2	·	·	·	13	542	-6.3	No record	85
20.00-	·	22	1	1	·	·	2	78	38	6	·	·	·	·	·	3	153	-1.8	Calm	2477
Total	199	874	447	416	192	96	89	428	795	1228	907	318	46	22	12	129	6198			
(%)	2.3	10.1	5.2	4.8	2.2	1.1	1.0	4.9	9.2	14.2	10.5	3.7	0.5	0.3	0.1	1.5	71.5			

May. to Oct.91(SW monsoon)

Direction / Velocity(kt)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	Total	(%)		
-4.99	2	11	5	3	7	7	15	32	96	405	556	223	38	11	6	4	1421	-32.6		
5.00-9.99	1	·	·	4	4	4	10	52	174	412	217	44	3	·	1	1	927	-21.2	Total	4416
10.00-14.99	2	·	·	·	3	·	10	121	315	278	55	3	·	·	·	·	787	-18.0	Observed	4364
15.00-19.99	·	·	·	·	·	·	2	107	134	37	1	2	·	·	·	·	283	-6.5	No record	52
20.00-	·	·	·	·	·	·	4	78	38	6	·	·	·	·	·	·	126	-2.9	Calm	820
Total	5	11	5	7	14	11	41	390	757	1138	829	272	41	11	7	5	3544			
(%)	0.1	0.3	0.1	0.2	0.3	0.3	0.9	8.9	17.3	26.1	19.0	6.2	0.9	0.3	0.2	0.1	81.2			

Jan. to April and Nov. to Dec.(NE monsoon)

Direction / Velocity(kt)	NNE 43.11	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	Total	(%)		
-4.99	47	188	132	124	93	59	41	25	20	55	58	18	3	8	4	34	909	-21.1		
5.00-9.99	51	214	134	146	49	23	4	12	15	26	13	12	·	3	1	38	742	-17.2	Total	4344
10.00-14.99	68	293	142	110	28	3	3	1	2	8	6	16	2	·	·	36	718	-16.7	Observed	4311
15.00-19.99	28	146	33	28	8	·	·	·	1	1	1	·	·	·	·	13	259	-6.7	No record	33
20.00-		22	1	1	·	·	·	·	·	·	·	·	·	·	·	3	27	-0.6	Calm	1657
Total	194	863	442	409	178	85	48	38	38	90	78	46	5	11	5	124	2654			
(%)	4.5	20.0	10.3	9.5	4.1	2.0	1.1	0.9	0.9	2.1	1.8	1.1	0.1	0.3	0.1	2.9	61.6			

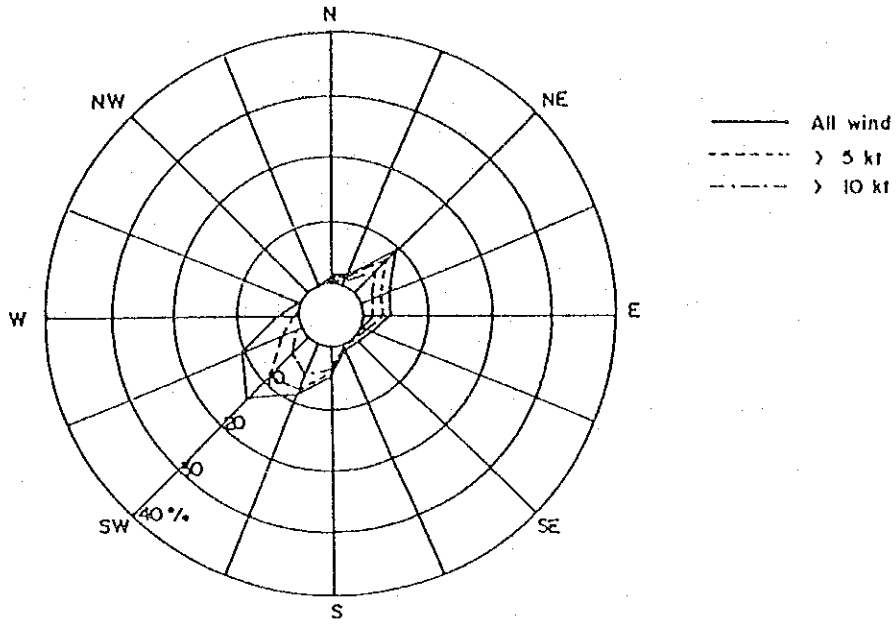


Figure 3-1 Wind Rose (1991)

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 2 km wide, between Lembeh and Sulawesi for about 16 km long in the NE - SW direction. Lembeh is a long narrow island (1 to 5 km wide and 23 km long) with the hills 200 to 450 m high.

7. Mt. Duasudara 1,351 m high and Mt. Batuangus 1,109 m high, both volcanic mountains, rise at the location 7 to 8 km inland from the coastline of Sulawesi. Bitung Port has a very narrow flatland rearwards blocked by these mountains, but is sheltered by Lembeh as a natural haven from the wave attack as shown in Figure 3-2.

C. Bathymetric Conditions

8. A trough approximately 40 m deep runs in the east-west direction along the mediate axis at the west opening of the Lembeh Strait. The coastline of Lembeh is rather indented. The seabed is scarcely covered with sediments in the Lembeh Strait as shown in Figure 3-2.

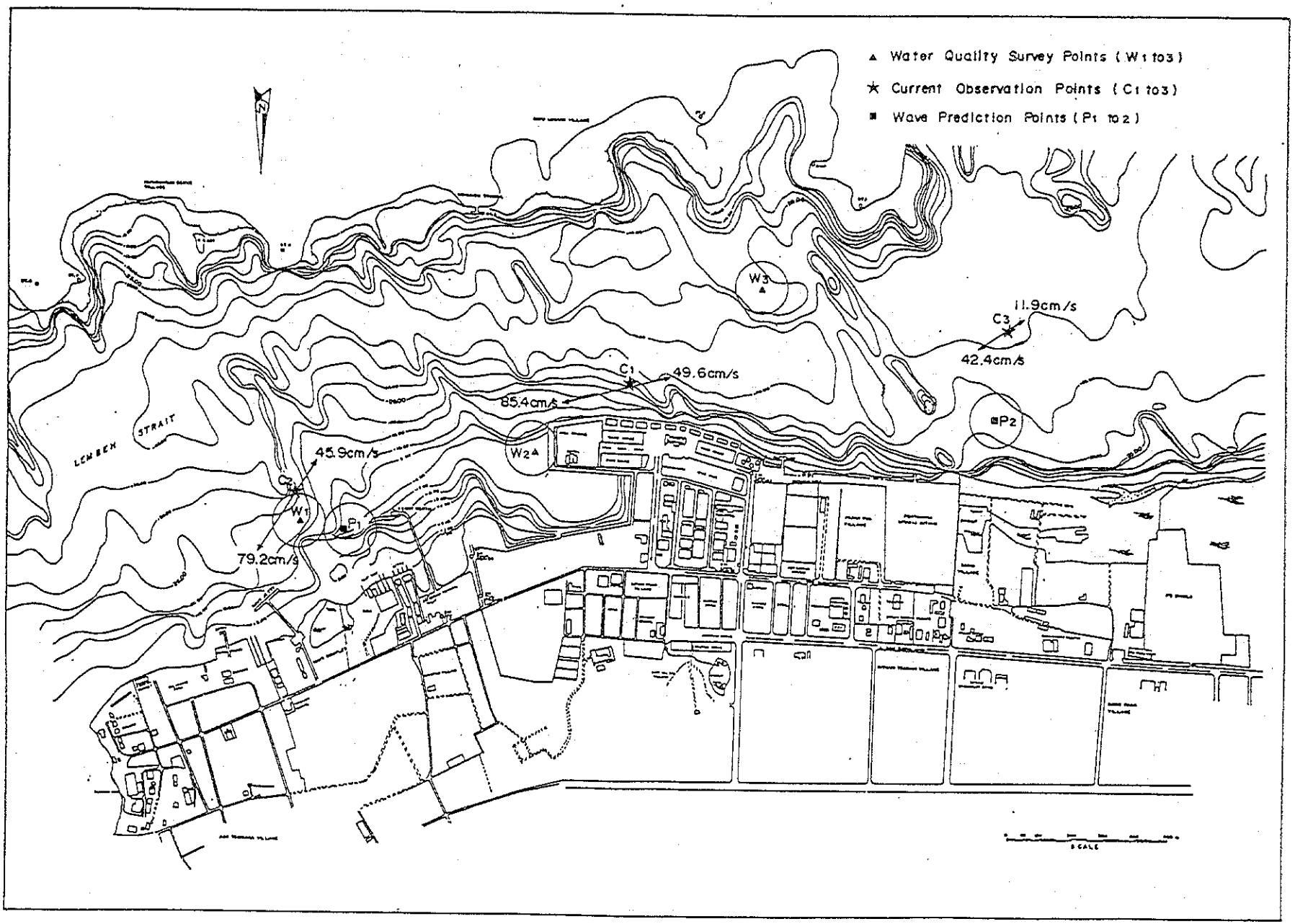


Figure 3-2 Bitung Port

D. Hydrographic/Oceanographic Conditions

Tide

9. According to the harmonic analysis of tide, semi-diurnal tide is prevailing in Bitung Port as shown in Table 3-3. HWL and LWL are fixed at +1.90 m and ±0 m, respectively in the JICA Report 1978.

Table 3-3 Tidal Constituents in Bitung

Item	M_2	S_2	N_2	K_1	O_1	M_4	MS_4	K_2	P_1	Z_0
A (cm)	36	26	6	28	11	–	–	7	9	120
g°	146	191	133	258	226	–	–	191	258	– –

Position : 01°27'N, 125°42' E
GMT : + 08.00
Survey : From January 18 to February 22, 1982

Current

10. Current condition at Bitung Port is as follows.

(a) Semi-diurnal tide prevails especially at C1 and C2. Current speed reaches around 1 m/s at C1 in the center of the Lembeh Strait as shown in Table 3-4 and Figure 3-3.

(b) Currents reciprocate parallel to the coastline or in the E-W direction at C1 and in the NE-SW direction at C2 and C3.

(c) Flood currents toward E to NE surpass ebb currents toward W to SW.

(d) During spring tide, flood currents reach 85.4 cm/s (75°, C1), 79.2 cm/s (32°, C2) and 42.4 cm/s (57°, C3), though ebb currents reach 49.6 cm/s (165°, C1), 45.9 cm/s (122°, C2) and 11.9 cm/s (147°, C3), where current direction is measured clockwise from the north (Figure 3-2).

Table 3-4 Tidal Current Ellipse

Position layer(m)	Date moon age	Axis	M1			M2			M3			Constant	
			ϕ °	V cm/s	H h	ϕ °	V cm/s	H h	ϕ °	V cm/s	H h	ϕ °	V cm/s
C1	Jul 79	L	63	16.0	0.1	75	58.2	0.4	293	6.6	5.9	69	18.0
-3.0	1 2	S	153	1.1	18.1	165	1.1	3.4	23	3.2	1.4		
	14.8	S/L		0.07			0.02			0.48			
C2	Jul 77	L	33	10.3	21.0	33	55.9	0.1	19	10.5	3.2	26	16.7
-3.0	4 5	S	123	2.7	3.0	123	4.9	9.1	109	0.0	1.7		
	17.8	S/L		0.26			0.09			0.00			
C3	Jul 77	L	74	6.6	14.8	59	16.3	0.4	86	4.9	3.8	58	15.3
-3.0	7 8	S	164	3.0	8.8	149	1.3	3.4	176	0.5	5.3		
	20.8	S/L		0.45			0.08			0.10			

Wave

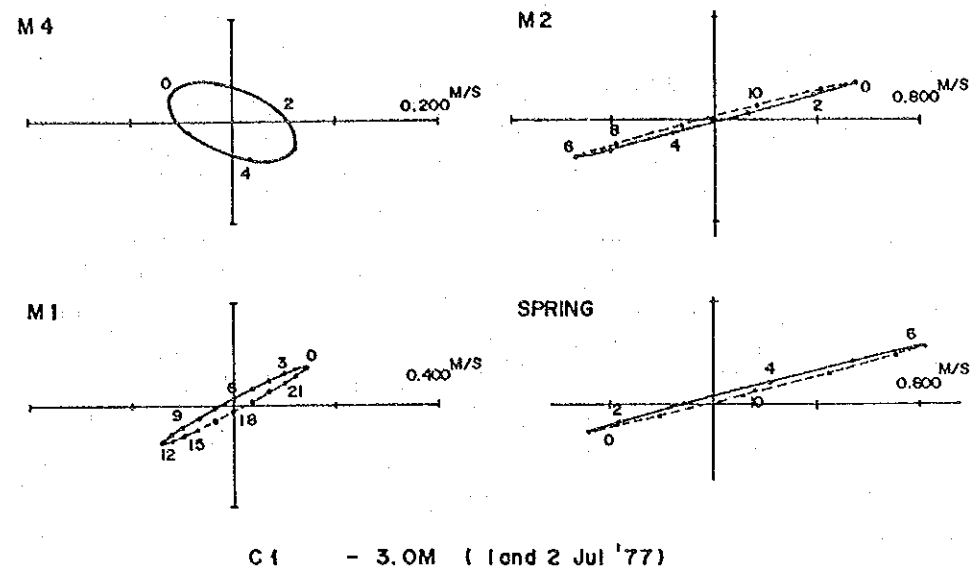
11. Waves are predicted at P1 and P2 based on the wind data in 1991 observed in Bitung, for they have never been observed in Bitung Port (Figure 3-2). Waves travel from SSW-SW and ENE as shown in Figure 3-4. Maximum significant waves are predicted as 0.50 m and 2.1 s (P1) and 1.91 m and 4.9 s (P2). P1 is far better protected than P2.

Littoral drift

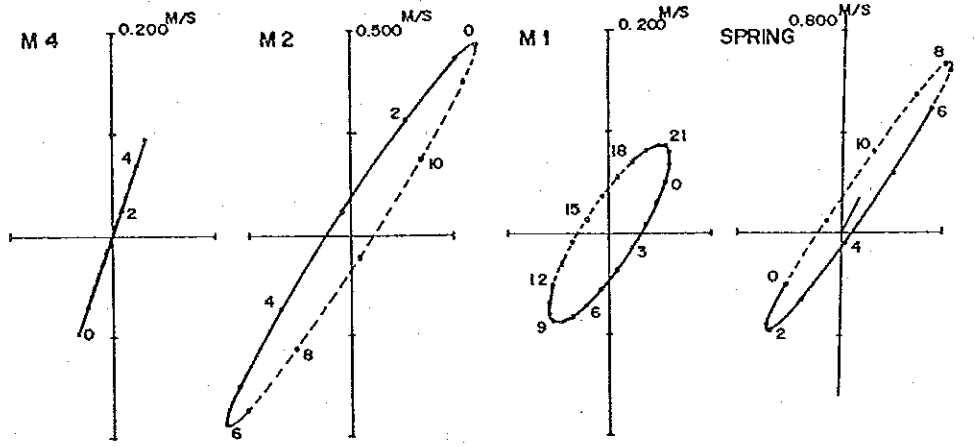
12. Judging from the survey results conducted in July 1977, sand on the shore west of the existing wharf will be possibly carried toward the wharf by waves from May to October. Because there exists no eroded or aggraded beach around the Port, some sand transported to the western edge of the existing 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

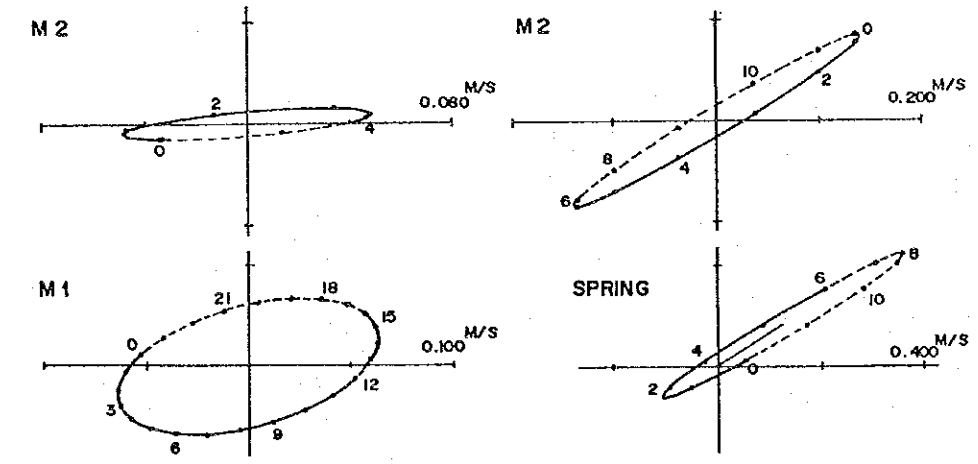
13. Sulawesi belongs to the tectonically unstable zone extending in the southeast direction from the Indo-China to the Makassar Strait lying east of Kalimanthan. In the island, an active anticline runs to form a narrow and long mountain range. North Sulawesi is situated at the southern edge of very active seismic zone extending to the Mindanao Island, the Philippines as shown in Figure 3-5.



C 1 - 3.0M (1 and 2 Jul '77)



C 2 - 3.0M (4 and 5 Jul '77)



C 3 - 3.0M (7 and 8 Jul '77)

O^h = high tide

Figure 3-3 Tidal Current Ellipse

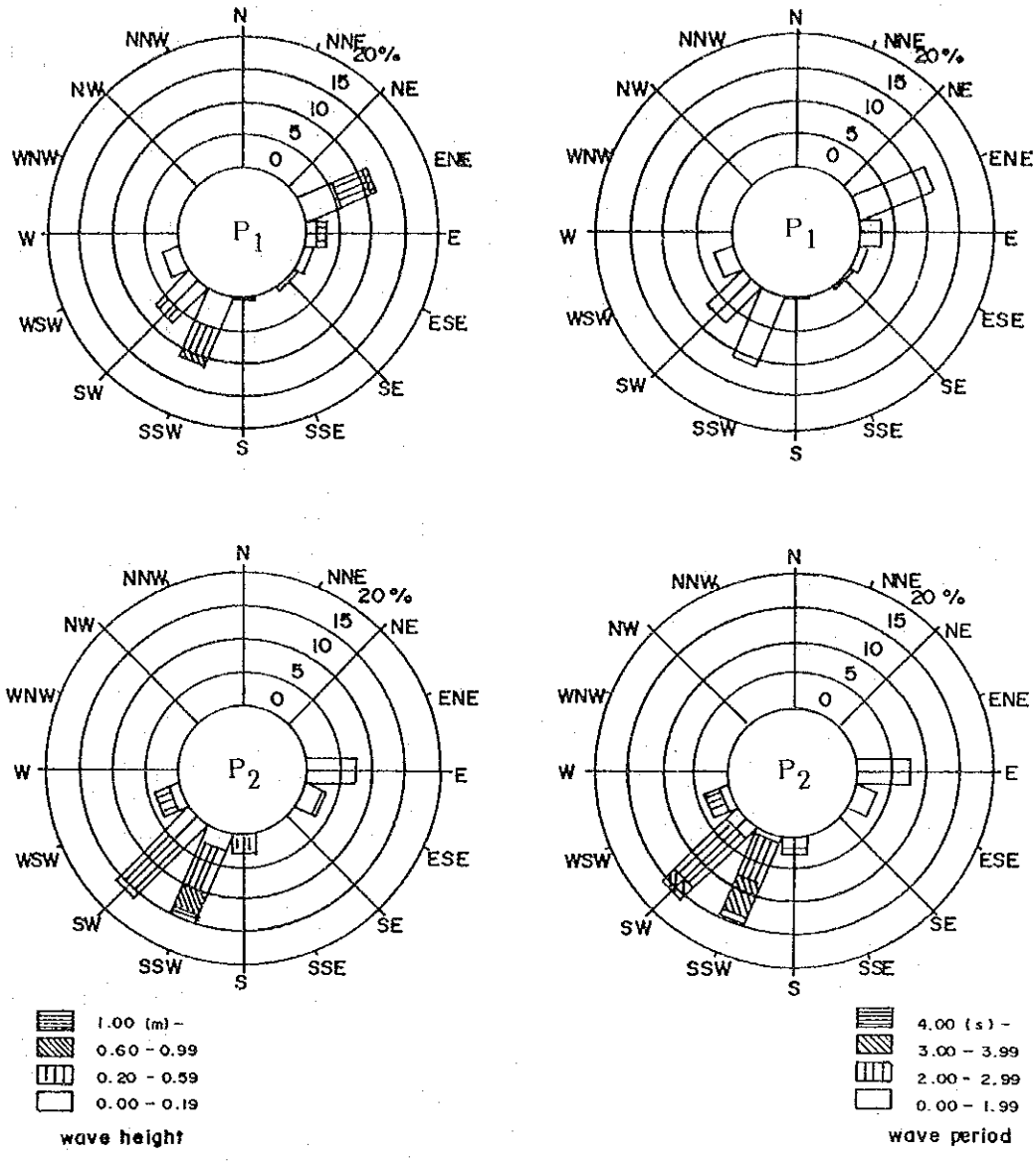


Figure 3-4 Wave Rose

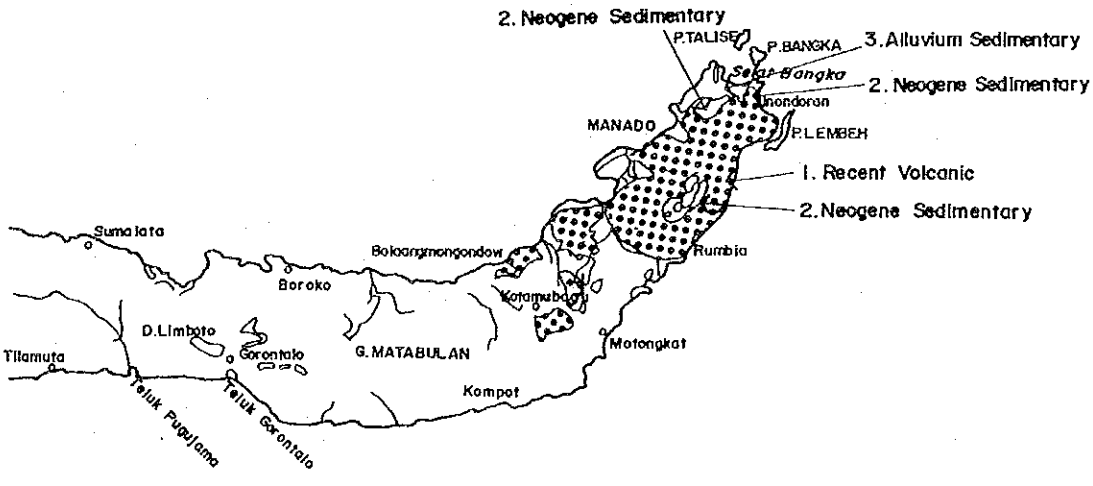


Figure 3-5 Geological Map

F. Seismic Activity

Earthquake

14. In North Sulawesi belonging to the Pacific Volcanic Belt, an earthquake frequently occurs. Volcanos are still active in the region covering form North Sualwesi to Sangihe Islands, and earthquakes sometimes occur in Bitung area. According to the seismic classification in Indonesia, seismic acceleration in and around Bitung area is 0.07 to 0.15 g.

Tsunami

15. Earthquakes are observed not only in the region covering from North Sulawesi to Sangihe Islands, but also in Halmahera Island. The epicenter centered in the Molucca Sea. Fortunately, Bitung Port has never suffered from the damage caused by tsunami. However, it can be attacked by tsunami, for many earthquakes occurred in the Molucca Sea.

G. Soil Conditions

16. Previous soil surveys in the port area of Bitung were conducted by a JICA study team 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. The location of these offshore boring executed and the seabed soil composition verified are shown in Figure 3-6.

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

18. Surface layer along the line C-C extending 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. Along the line C-C, in general, a hard layer of limestone underlies the surface layer uniformly at the elevation of -30 m, but at the seabed near the wharf the hard layer is found at the elevation of -15 m. The offshore boring executed at the Point B-1 for the present study revealed that any soft layers do not exist at this boring point.

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 -25 m.

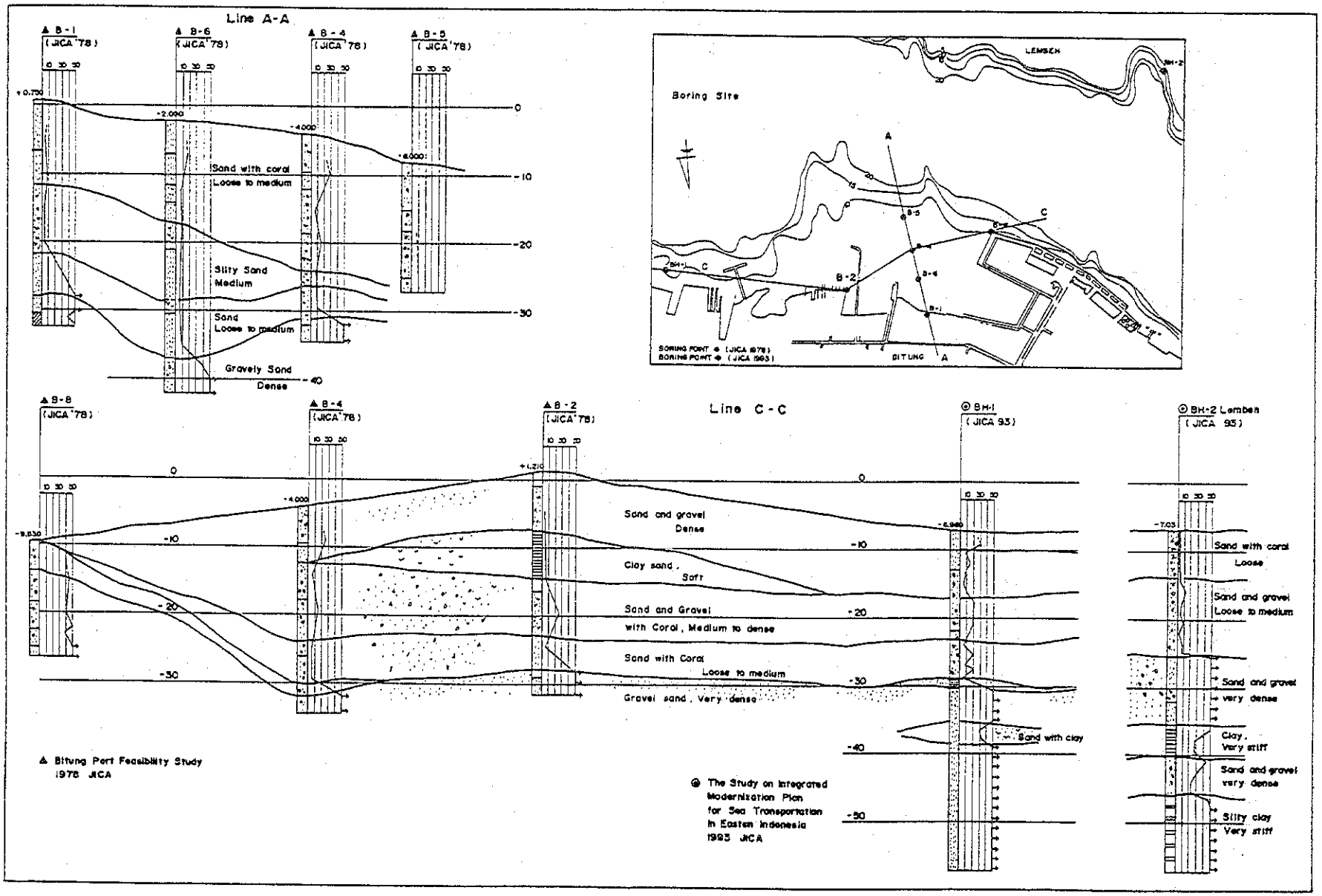


Figure 3-6 Soil Condition

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 W1 to W3 at the depth of 0.5 m 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 as shown in Figure 3-2. The surveys covered 8 physical and chemical items; water temperature, salinity, pH, dissolved oxygen, transparency, COD, SS and turbidity as shown in Table 3-5.

Table 3-5 Water Quality Surveys in Bitung Port

Data of Spring Tide : August 31, 1993
Time of High Tide : 05:40 - 06:40
Time of Low Tide : 11:35 - 12:35

Time	Point W-	Water Depth (m)	Sampling Depth (m)	Trans-parency (m)	Tempera-ture (℃)	pH	DO (mg/ℓ)	Salinity (‰)	COD (mg/ℓ) $K_2Cr_2O_7$	Turbidity (NTU)	SS (mg/ℓ)
High Tide											
05:40	1	32.0	16.0	16.0	26.2	8.29	8.1	3.32	21.9	6.0	19
05:50			0.5		26.4	8.20	8.0	3.33	26.5	6.5	24
06:05	2	9.0	4.5	9.0	26.5	8.32	8.3	3.31	32.3	7.0	23
06:15			0.5		26.5	8.30	7.9	3.32	58.8	6.5	32
06:25	3	32.0	16.0	15.0	26.1	8.30	8.1	3.31	28.1	6.5	14
06:40			0.5		26.4	8.31	8.1	3.30	39.8	7.0	30
Low Tide											
11:40	1	30.0	15.0	16.0	27.5	8.29	8.3	3.29	19.6	6.5	14
11:50			0.5		27.3	8.35	7.6	3.31	32.2	7.0	31
11:55	2	7.0	3.5	7.0	27.0	8.22	8.1	3.30	28.5	7.0	24
12:05			0.5		27.3	8.29	7.2	3.28	55.4	6.5	28
12:20	3	30.0	15.0	14.0	27.1	8.28	8.1	3.32	22.2	6.0	15
12:35			0.5		26.9	8.24	8.1	3.29	32.0	6.5	30

Chapter 4 DEVELOPMENT POTENTIAL OF THE PORT HINTERLAND

A. 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. North Sulawesi is a famous copra producing area of Indonesia. Plantation has long been the backbone of the regional economy; in 1991 nearly 300,000 tons of coconuts were harvested and products include coconut oil, coconut powder, and charcoal for activated carbon. Kabupaten Minahasa, which comprises areas of great importance to the port of Bitung, is the major plantation area, containing over half of the coconut plantations and about two thirds of the clove areas.

3. Cloves are shipped to Java for the production of clove cigarettes; the area under cultivation in 1991 was 43,650 ha with more than 8 million clove trees. During the great harvest time, every four years, the production amounts to 30,000 tons.

4. There is considerable potential for expansion in rattan, kayu hitam (literally black wood), Philippine mahogany, and mangrove forest production, and in forward linkages through saw milling and furniture manufacturing.

5. The size of North Sulawesi's production forest is around 940,000 hectares, with another 293,000 hectares which can be converted to production.

6. Fisheries is another potential growth industry. 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. North Sulawesi is surrounded by 28,000 ha of mangroves, of which about 5,000 ha are considered suitable for shrimp production. The provincial government claims that only a small percentage of the region's seas are being harvested and that there is potential for much more development.

7. Development of Bitung fishery port will be realized during the coming REPELITA VI in the anticipation of promoting the fishery activities. The location of the new fishery port is proposed approximately 2 km east of the commercial port of Bitung. Domestic fund will firstly be used for the project, and then foreign financial assistance may be sought. Total construction cost is estimated at Rp.9.1 billion.

8. The fishery port development project has two phases. In the first stage, 300 m quay with water depth of -5 m alongside will be constructed on the reclamation area of 40 m width. On top of that, a jetty with - 8 m draft for 2,000 DWT ships will be constructed for export promotion. More than 300 tons a day of fish is expected to be handled at this fishery port. A cold storage of 600 tons is planned to be erected. In the second phase, the 200 m quay will be expanded.

B. Development Potential of the Secondary Sector

9. At the end of Repelita IV, eight industrial growth centres were identified in Indonesia; 1. North Sumatra, 2. South Sumatra, 3. Java & Bali, 4. Eastern Kalimantan, 5. Sulawesi, 6. Batam, 7. Southern part of East Indonesia, and 8. Northern part of East Indonesia

10. North Sulawesi province can be a relatively industrialized province in Eastern Indonesia. Several types of manufacturing factories are already in operation although they are medium or small scale industries; 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.

11. 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 a zone which has supplies of power, water, warehousing and access road to the major transportation terminals, and is expected to play the most central role in the industrial activities in the northern part of Eastern Indonesia.

12. According to Municipality of Bitung, it is proposed that the Kabima Industrial Estate should be expanded by 300 hectares. Furthermore, Investment Coordination Board of North Sulawesi province said that future development plans of the Kabima Industrial Estate were under study, and that possible outcome of the study would be a 1,000 ha expansion.

13. Potential for general manufacturing of light, consumer goods may exist in Manado, Bitung, or Kabima area where relatively dense and affluent markets exist in the immediate area and in the accessible hinterland. In these areas, local manufacturing of goods, which are of relatively low unit value and have low bulk/weight ratio (heavy goods) or a very high bulk/weight ratio (very bulky goods) so that transport cost is a large portion of total value (price paid by the consumer), could compete with imports from Java, because of high transport costs. Examples of such goods are processed food and drink (heavy goods) and building materials (heavy ad bulky goods). A soft drink manufacturing factory has been established in Manado.

14. In order to promote industrial activities, it is necessary to provide power and water to factories. The potential of North Sulawesi for electric power is huge, and is estimated at 3,000 megawatts. Hydraulic energy can be found on 30 rivers, and a hydro electric plant has been installed and in operation in the south of Manado. In 1991 only 125 megawatts were exploited.

15. According to the Ministry of Mines, North Sulawesi province has a substantive potential for energy. Geothermal energy resources are found at Lahendong Tompaso and Kotamobagu. The conservation of this energy is estimated at 600 megawatts. Pertamina has been tapping this geothermal resource with the construction of a 60 MW electricity generator in Lahendong.

C. Agro-Industry

16. Agro-processing seems to have received spill-over effects from the enthusiasm for tree crops and forestry, combined with the national requirement that each province include development of its manufacturing sector in planning.

17. Bappeda of North Sulawesi province is highly likely to place Agro-industry as a prime mover of the provincial economic activities in the coming Repelita VI period. Agro-processing is, in fact, a potential sector considering the existing industrial structure, resources, and market of the province.

18. Industrial development of North Sulawesi will be centred on agro-industry. Realization of these manufacturing prospects rely, however, on diversification and productivity improvement in agriculture, including coconut, coffee and livestock as well as improvement of transportation infrastructure to support the field-to-processing trip and the processing-to-market trip.

D. Development Potential of the Tertiary Sector

19. 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 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.

20. 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 exiting narrow strip leading to Likupang. It is speculated that the earth strip, which is presently a provincial road, will be upgraded to a national road after completion of the civil works under way.

21. Construction works are under way to develop a resort at Likupang, 34 km from Manado Airport. The resort has a 450 hectares area of land surrounded by white sandy beach and panoramic hills. Construction of Phase-I, the first complex of 250 rooms, including various types of facilities such as marina, golf course, swimming pools, has already started and is expected to be completed in 1994. Construction of additional hotels, golf courses and other various recreational facilities will start in 1995 after completion of Phase-I.

22. The road network in the province has improved significantly since 1970 and that in Minahasa and the eastern part of Bolaang Mongondow is now quite good. 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. The width of the road is 6 to 8 m, and will be completed in 1994.

23. 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 although the airport has been accommodating DC 9 and Air Bus (A 300) type aircraft. Cargo planes come from Davao twice a week, from Saipan five times a

week, and from Singapore twice a week. Fresh tuna is being exported as air freight to Japan using these cargo planes.

24. One of the 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.

25. Manado is closer to Manila than it is to Jakarta; it is closer to Davao City (on the southern Philippine island of Mindanao) than it is to Ujung Pandang. Containers of canned fish have been exported to General Santos, Mindanao, the Philippines.

26. 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. The port of Bitung is expected to ship 45,000 tons of coconut shell to Darwin to manufacture activated carbon there.

E. Long-term Development Plan of Bitung Municipality

27. 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, as well as for the need of other types of activities such as housing and tourism promotion.

28. According to Kanwil of Ministry of Public Works of North Sulawesi province, 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 because existing port layout is physically limited and bounded by urban activities to the north, ferry jetty to the east, Lembeh strait to the south, and Pertamina to the west.

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. The hinterland of the port of Bitung is determined from the data on the origin and destination of cargo passing through the port and from the inland transportation situation described in Chapter 2, Section B.

3. 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

4. According to the census taken in 1990, the population of Indonesia is about 179 million, North Sulawesi Province 2.5 million, Central Sulawesi 1.7 million, and Maluku Province 1.9 million. This represents 2.2% of the total Indonesian population.

5. The future population was estimated through a cooperative venture between the Demographic Institute of University of Indonesia and the National Development Planning Board in Table 5-1.

Table 5-1 Projected Population

Unit : thousand

Year	1990	1995	2000	Annual Growth Rate (%)
Indonesia	179,379	198,950	215,863	1.87
N.Sula.	2,478	2,635	2,783	1.17
C.Sula.	1,711	1,922	2,139	2.26
Maluku	1,856	2,056	2,254	1.96

Source : Population Projection of Indonesian Province 1990-2020
The Demographic Institue of University of Indonesia
and the National Development Planning Board

6. Based on projections of the above cooperative venture, 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 hinterland in 2000 is estimated to be about 7,176,000.

Economy

7. 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.

8. Table 5-2 shows actual annual growth rate of GRDP in North Sulawesi by sector. In 1988/1990 GRDP rate is 7.7 percent, and several sectors such as Agriculture, Mining & Quarrying, Elect. Gas and Banking exceed the average rate. It is assumed that GRDP growth rate by sector will not change significantly through 2000.

Table 5-2 GRDP Growth Rate Accutual and Forecast of North Sulawesi

Unit : (% / year)

	Industrial Origin	1983/1984	1984/1988	1988/1990
1	Agriculture	-6.9	6.8	10.1
2	Mining & Quarrying	5.1	21.7	15.3
3	Manufacturing Industries	5.8	1.1	7.1
4	Elect.,Gas & Water Supply	3.9	9.1	8.7
5	Construction	10.1	0.7	2.9
6	Trade, Restaurant & Hotel	2.3	4.6	7.3
7	Transport & Communication	5.9	6.0	6.4
8	Banking & Other Financial Intermediaries	8.5	9.8	34.8
9	Ownership of Dwelling	2.1	3.1	4.3
10	Public ADM. & Deffence	7.8	2.9	2.9
11	Services	8.5	2.9	3.4
	Total	1.4	4.9	7.7

Source : Regional Income of Provinces Indonesia by Industrial Origin 1983-1990, BIRO

B. Methodology for Demand Forecast

9. 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.

10. Two methods are used for the macro forecast. One is to grasp the trends of cargo handling volume from the past data and forecast the volume by a time series analysis. The other is to correlate the past cargo handling volume at Bitung Port to regional social or economic indices such as population or GRDP, and to forecast the future cargo volume using future estimates of these regional figures.

11. After categorizing the major commodity groups into the following groups, the volume of major commodity and the other commodity groups is forecast individually and the total cargo volume is then calculated by the summation of these volumes (Rice, coconut product).

12. As the economic activities expand, the passenger flow will also increase and the number of passengers in future can be forecast by following index. The most representative economic index is GRDP, by which the passenger flow through the port can be estimated.

C. Macro Forecast

Correlation with social and economic indices

13. The total cargo volume is forecast by correlation with GRDP. The following formulation shows the relation between total handling volume at Bitung Port and GRDP.

Y = 1.35529 x GRDP - 222,235 (R = 0.920)

Where,

Y : Cargo demand in Bitung Port (ton)
GRDP : GRDP in North Sulawesi (Rp.Mill in '83 constant price)
R : Correlation coefficient

14. When GRDP in the target year mentioned in chapter 5 section A is input into this equation, the forecast of cargo volume to be handled at the port of Bitung in 2000 is 2,214,000 tons.

Times series analysis

15. The cargo volume of Bitung Port for the target year will be forecasted using a time series analysis. The cargo volume is assumed to be expressed as;

Y = 63,432.39 x YEAR - 1.25E+8 (R = 0.963)

Where,

Y : Cargo demand in Bitung Port (ton)
YEAR : Target year
R : Correlation coefficient

16. The cargo volume in target year is estimated 1,675,000 tons.

Result of macro forecast

17. The result of the macro forecast in the target year is shown below.

Target year	2000
Handling volume	1,675,000 - 2,214,000 tons

D. Micro Forecast

18. Considering the present cargo volume, long term trend and package type by commodity, the cargo handled at the port of Bitung is classified into the following 13 categories for the micro forecast.

(1) Rice
(2) Foodstuffs excluding rice
(3) Coconut oil
(4) Coconut product
(5) Agriculture product excluding coconut product
(6) Fertilizer
(7) Production material excluding fertilizer
(8) Wood
(9) Asphalt
(10) Cement and material
(11) Construction material
(12) Vehicle
(13) Miscellaneous

19. Volume of each commodity group is forecast according to its particular characteristics. The resultant commodity growth rates in the cargo forecasts are shown in Table 5-3. The following outlines the methods employed for the forecasting of each commodity group.

Table 5-3 The Commodity Growth Rate

Unit : %

	Commodity	Annual Growth Rate
1	Rice	3.1
2	Foodstuffs	9.0
3	Coconut Oil	1.7
4	Coconut Product	1.7
5	Agriculture	9.2
6	Fertilizer	3.3
7	Production Material	7.5
8	Wood	10.0
9	Asphalt	10.0
10	Cement and Material	9.7
11	Construction Material	10.0
12	Vehicle	7.5
13	Miscellaneous	7.5

(1) Rice
Demand increase reflects population growth, per capita consumption growth and increased area harvested.

(2) Foodstuffs excluding rice
Demand will be forecast by correlation with GRDP.

(3) Coconut oil
Demand increase is commensurate with coconut product by the forecast of Department of Agriculture in North sulawesi.

(4) Coconut product
Demand increase is commensurate with coconut product by the forecast of Department of Agriculture in North sulawesi.

(5) Agricultural product excluding coconut product
Demand increase is commensurate with annual growth rate of agriculture sector GRDP.

(6) Fertilizer
Demand increase is commensurate with consumption growth of Indonesia.

(7) Production material excluding fertilizer
Demand increase is commensurate with annual growth rate of GRDP of North Sulawesi.

(8) Wood
Demand increase is commensurate with annual growth rate of past maximum construction sector GRDP.

(9) Asphalt
Demand increase is commensurate with annual growth rate of a past maximum construction sector GRDP.

(10) Cement and material
Demand will be forecast by correlation with GRDP of North Sulawesi.

(11) Construction material
Demand increase is commensurate with annual growth rate of a past maximum construction sector GRDP.

(12) Vehicle
Reflects annual growth rate of GRDP of North Sulawesi

(13) Miscellaneous
Reflects annual growth rate of GRDP of North Sulawesi

20. Table 5 - 4 shows a summary of the forecast cargo, and Table 5-5 is acomparison of cargo volumes obtained by the macro and micro forecast methods described in chapter 5 C. Macro Forecast and 5 D. Micro Forecast.

Table 5-4 Result of Micro Forecast at Bitung Port

Unit : 1,000 ton

	Commodity	G.Cargo	Solid Bul	Liqud 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	267	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 5-5 Forecast of Total Cargo Volume in Target Year

Unit : ton

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

21. 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

22. Figure 5-1 shows the number of passenger getting on and off at Bitung Port. There is a clear growth tendency until 1992.

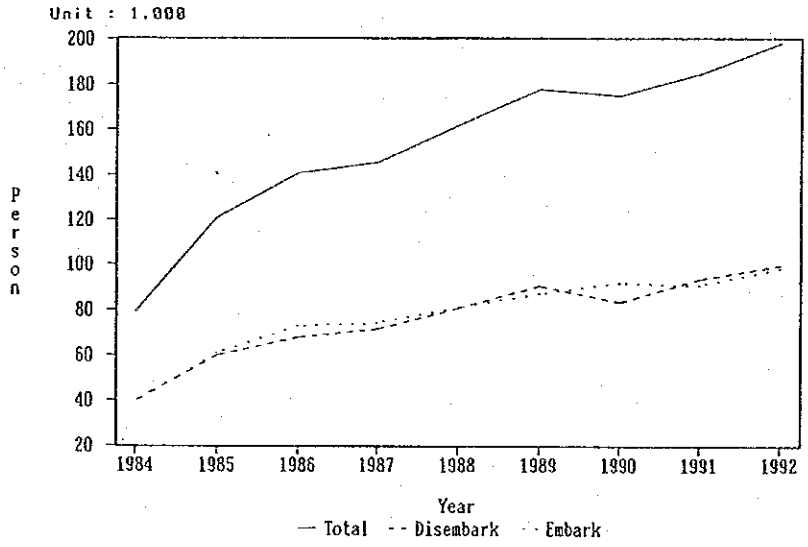


Figure 5-1 Passenger Traffic at Bitung Port

23. The demand for sea passenger traffic in target year is forecast based on the single regression model.

$$Y = 0.3016276 \times GRDP - 95,813 \qquad (R = 0.865)$$

Where,

Y : Demand of sea passenger traffic in N.Sulawesi Pro.
GRDP : GRDP in North Sulawesi (Rp.Mill in '83 constant price)
R : Correlation coefficient

24. When the target year is input into this equation, 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

25. 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 containerization from the port statistic data.

26. The main categories of the containerizable goods include most foodstuffs, manufactured goods, refined sugar, chemical product and so on. Other cargoes such as cement, stone, cereal, liquid bulk, timber and metal product have been pronounced unsuitable for containerization.

27. The containerization rate is the percentage of the volume of containerized cargo to the containerizable cargo. The containerization rate in target year is forecast based on the logistic curve method as shown in Figure 5-2.

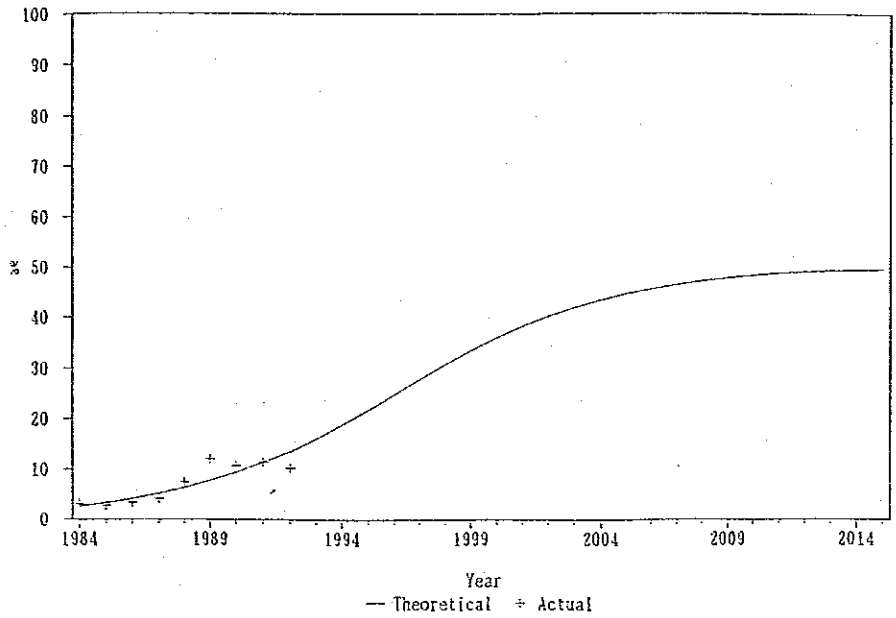


Figure 5-2 Containerization Rate at Bitung Port

28. Volume of container cargo forecast is shown in Table 5-6. The volume of container cargo in target year can be obtained from the general cargo by the package type.

Table 5-6 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

Necessity of the revision of the port development plan

1. As discussed in Section H, Chapter 2, port facility improvement works at the port of Bitung have been based on the master plan study completed in 1984. This existing master plan forecast future economic and maritime activities in the region reasonably well, and formulated a sound facility development plan for the port.

2. Since the formulation of this master plan, however, drastic changes in national maritime policy have been observed. In addition, some of the premises set in the existing master plan have proved to be false. Changes in planning conditions include;

a) The existing master plan was formulated under the framework of the gateway policy and ILS concept although influence on the cargo throughput at the port was forecast to be minimal. In reality, the Indonesian government issued PAKNOV 21/88 to deregulate shipping activities in 1988 as discussed in Chapter 5, Part 1 of the present study.

b) The existing master plan forecast that the ILS routes will be containerized after 1990. The ILS concept, however, has been abolished, and almost all shipping services are tramper after PAKNOV 21/88.

c) The existing master plan was proposed on the premise that a cement bagging plant with its own wharf for mechanized unloading of bulk cement was under construction at the port of Bitung, and that this plant was scheduled to start operations by the end of 1984. In reality, however, this project has been postponed and operations will not commence until 1995/96.

d) A proposed site where a container terminal will be expanded is now occupied by the Ferry jetty, which started operation in May 1993.

3. Description above fully explains the necessity of revising the existing master plan of the port of Bitung. Furthermore, Bitung area is conceived as one of the growth centers of the national economy by fully utilizing its rich natural resources and locational advantage. In addition, "Triangle of Growth" concept has been proposed, and Bitung, North Sulawesi, constitutes one of the apexes of the international triangle. Bitung is now one of the focal points in the regional, national, and international economies. These prospects of the Bitung area were not fully incorporated in the existing master plan.

Development policy of the port of Bitung

1) The port should not be a hindrance to regional economic development

4. North Sulawesi is one of the resource rich provinces as explained in a previous chapter. Many projects covering several sectors such as industry, agriculture, and tourism have been proposed to fully exploit its natural resources, and some of them are in the implementation stage.

5. One of the most important policies concerning Bitung port development is that the port of Bitung should not be a hindrance to economic development of the region and the nation. Many in business circles and government bodies regard the present situation of the port of Bitung as a hindrance to regional economic development.

2) Container handling capability of the Bitung port should be significantly improved

6. The reason for the above claim stems from the fact that Bitung port cannot handle containers in an efficient way at the moment because containers are currently handled at conventional general cargo berths, and because efficient cargo handling equipment has not been prepared.

7. Containerization will progress as the hinterland is gradually industrialized. Although the economic structure in North Sulawesi has been dominated by the primary sector, relative importance of the secondary and the tertiary sector will increase year by year. New policy to promote agro-industry in the province will directly and strongly necessitate the enhancement of the container handling capability at the port of Bitung.

3) Bitung port should improve its function as the gateway port in the northern part of East Indonesia

8. North Sulawesi has a locational advantage, being on the Pacific Rim where the growth of economic activities has been rampant. Bitung port is located closer to Japan, Hong Kong, and Korea than any other major ports in Eastern Indonesia.

9. "Triangle zone of East ASEAN economic growth" concept has been proposed. This concept involves Mindanao island in Southern Philippines, Sulawesi island, and Borneo island, which is composed of Indonesia, Malaysia, and Brunei. Within the triangle 40 million people are living. It is certain that trade will be greatly enhanced if AFTA is completed in 2007 as planned.

Planning framework

10. Following planning framework can be proposed in the present study. This framework is an outcome from the discussions among DGSC, state-owned port company, and JICA study team.

11. Port of Manado will be closed and converted to a marina Existing function of Manado port is moved to Likupang port

i) Port of Manado will be closed because development of a coastal road which passes through the Manado port has been proposed.

ii) Likupang port will be developed to replace Manado port, which will become a tourism port. Local vessels under 500 m3 which call Manado port will move to the Likupang port. Construction works of Likupang port will be finished in 1997.

12. Fishery boats at Bitung port will move to a new fishery port

i) Fishery port is going to be built near the Bitung port. Fishery boats will move to the new fishery port. Bitung port will be used only for the exportation of the fishery products.

13. Cement packing plant will be constructed

i) A cement packing plant is proposed for construction at Bitung port. The capacity of the plant is 200,000 ton/year. The cement packing plant will be operational in 1995/96.

14. Summary of the port function

Bitung port will be developed as
(a) Container port
(b) Ocean going ship port
(c) Interisland ship port
(d) Passenger ship port
(e) Cement bulk carrier port

Hinterland of the Bitung port

15. Hinterland of the Bitung port is, in the short run, the entire region of North Sulawesi province, especially the northern part of the province. In addition, northern part of Maluku province currently constitutes a part of the hinterland of the Bitung port.

16. In the long run, however, the port of Bitung will function as the gateway port for the northern part of Eastern Indonesia provided that the port of Bitung has sufficient port facilities needed to meet expectations from the hinterland.

B. Present Capacity of the Port

Optimum berth occupancy

17. 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.

18. The capacity of the berthing facilities is defined as cargo volume when the berthing facilities are optimally utilized. The optimal berth occupancy is the berth occupancy for which annual costs and benefits of berth extension are equal to each other. The optimal berth occupancy depends on the cost of new quays (including back-up facilities), the waiting cost of vessels in port and the number of interchangeable berths. To provide a preliminary indication of quay extension requirements, provisional optimal berth occupancies have been obtained from the ISTS study:

Number of berths	1	2	3	4
Optimal berth occupancy	55%	59%	61%	63%

19. According to UNCTAD monograph, the figures given below are suggested in principle to be regarded as desirable occupancy rates for multipurpose terminals:

Number of berths	Berth occupancy rate
1	30 %
2	50 %
3	65 %

20. As indicated above, the optimum berth occupancy increases with the increase of the number of berths available. The berthing facilities at the port of Bitung are basically divided into two categories: Oceangoing Wharf and Interisland Wharf. The Oceangoing Wharf consists of four berths including Chemical Berth, and the Interisland Wharf consists of six berths. Considering the number of existing berths at the port, the optimum berth occupancy at each wharf can be estimated as follows:

65 % for the Oceangoing Wharf
70 % for the Interisland Wharf

Capacity of the existing berthing facility

1) Calculation based on ship productivity

21. Existing berth capacity is volume of cargo which can be handled at the berth at the rate of the optimum berth occupancy, and is expressed in the form of tons per meter per year.

22. One method to estimate the existing berth capacity is based on ship productivity, and can be expressed in the following empirical formula:

$$C = N \times 24 \times U \times BPI / L$$

in which

C = optimum berth throughput (ton/m/year)
N = number of working days per year
U = optimum berth occupancy
BPI = cargo loaded/discharged per ship-hour at berth (ton/hr)
L = quay length occupied by a berthing vessel (m)

23. According to the branch office of PERSERO IV, cargo handling operation cannot be practiced for about 5 days a year due to special national holidays. In addition, cargo handling operations are postponed or interrupted while PELNI passenger ships are berthing at the quay. Bad weather also affects the working conditions. Considering the conditions above, number of actual working days at the port is estimated at 320 days per a year.

24. 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. The main findings can be summarized as follows;

(a) Oceangoing Wharf

Number of Vessels	40	vessels
Ave. Ship Length	76.88	m
Ave. DWT	2,322.70	DWT/ship
Ave. Cargo Volume	2,278.36	ton/ship
Ave. Waiting Time	4.54	hr/ship
Ave. Berthing Time	71.51	hr/ship
Ave. Ship Productivity	31.86	ton/ship-hour

(b) Interisland Wharf

Number of Vessels	71	vessels
Ave. Ship Length	28.94	m/ship
Ave. DWT	251.90	DWT/ship
Ave. Cargo Volume	330.62	ton/ship
Ave. Waiting Time	17.40	hr/ship
Ave. Berthing Time	113.61	hr/ship
Ave. Ship Productivity	2.84	ton/ship-hour

25. Quay length (L) occupied by a ship can be estimated based on the average ship length and allowance as 95 m for Oceangoing Wharf and 30 m for Interisland Wharf.

26. Existing berth capacity can be estimated as 1,676 ton/m for Oceangoing Wharf and 502 ton/m for Interisland Wharf.

2) Calculation based on gang-productivity

27. Another method to estimate the existing berth capacity is based on gang productivity, and can be expressed in the following empirical formula:

$$C = N \times H \times U \times GPI \times n / L$$

in which

C = optimum berth throughput (ton/m/year)
N = number of working days per year
H = number of working hours a day
U = optimum berth occupancy
GPI = cargo loaded/discharged per gang-hour (ton/hr)
L = quay length occupied by a berthing vessel (m)

28. As explained in Section G, Chapter 2, actual working hours are 18 hours a day at the maximum even when extra shift is requested by users.

29. According to the branch office of PERSERO IV, gang productivities at the Bitung port are 15-18 ton/g/h for general cargo, 19-24 ton/g/h for bagged cargo, 30-40 ton/g/h for chip of copra, 18-22 ton/g/h for palletized cargo, and 17 ton/g/h for liquid cargo in drum as shown in Section G, Chapter 2. In the present study, 21.5 ton/g/h is assumed as the average gang productivity at the port of Bitung. Furthermore, two gangs on average are assumed to be engaged in cargo handling operations for 2,000 - 2,500 DWT vessels.

30. The capacity of the existing berth can be calculated as 1,695 ton/m for Oceangoing Wharf.

31. The Interisland Wharf has been mainly utilized for relatively small vessels which ply between Bitung and neighboring small islands of North Sulawesi and Maluku province. For these vessels, berthing time cannot be decided only by cargo handling productivities, because they moor along the quay waiting for passengers and cargoes, and sometimes for resting. Therefore, the capacity of the Interisland Wharf cannot be calculated based on the gang productivities.

3) Summary of capacity of existing berth

32. From the discussions above, 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
500 ton/m x 502 m =	251,000 ton/year	for Interisland
Total	1,527,700 ton/year	

Capacity of existing storage facility

33. Capacity estimation of existing storage facilities is a necessary step for the determination of magnitude of additional storage facilities to accommodate the anticipated traffic in 2000.

34. The capacity of the storage facilities is defined as cargo volume when the storage facilities are optimally utilized. The optimal utilization means that the storage facilities are used based on the standard conditions, i.e., "safe cargo handling system", "standard working time" and "effective usage of the storage facilities".

35. Port of Bitung has the following public storage facilities at present.

1) Transit sheds
2) Open storage areas
3) Container yard

1) Transit sheds

36. In general, the capacity of a transit shed is calculated by the formula shown in Appendix 6-1.

37. In this study, the factors were based on the present practices in this port. According to the information of Bitung branch office of PERSERO IV, existing transit shed floor area is 12,960 m^2, the average dwelling time is 3 days and the operating days are 320 days per year. Based on the standard data, the peak ratio is 1.3, the effective storage area ratio is 0.6 and the volume of cargoes per unit area is 1.5 tons/m^2.

38. Existing capacity of the transit sheds at this port can be estimated as about 957,000 tons.

39. According to the head office of PERSERO IV, the shed throughput (STP) is 29 tons/m^2 in 1992. Therefore, the volume of cargoes through the transit sheds in 1992 can be estimated as about 376,000 tons.

40. According to the above results, it seems that the present transit shed can handle about two and half times the volume of the present level.

2) Open storage areas

41. The capacity of open storage area is also calculated by the same formula. According to the information of Bitung branch office of PERSERO IV, existing open storage areas are 15,500 m^2, the average dwelling time is 5 days and the operating days are 320 days per year. Based on the standard data, the peak ratio is 1.3, the effective storage area ratio is 0.6 and the volume of cargoes per unit area is 1.5 tons/m^2.

42. Existing capacity of the open storage areas at this port can be estimated as about 687,000 tons.

43. According to the information of the head office of PERSERO IV, the open storage throughput (OSTP) is 28 tons/m^2 in 1992. Therefore, the volume of cargoes which passed through the open storage areas in 1992 can be estimated as about 434,000 tons.

44. According to the above results, it seems that the present open storage areas can handle about one and half times the volume of the present level.

3) Container yard

45. In general, the capacity of a container yard is calculated by the formula shown in Appendix 6-2.

46. According to the information of Bitung branch office of PERSERO IV, existing container yard area is 4,000 m^2, the average dwelling time is 10 days, the average stacking height is 2 stacks and the operating days are 320 days per year. Based on the standard data, the storage area per TEUs is 60 m^2/TEU, the peak ratio is 1.3, the working area factor is 0.5 and the effective storage area ratio by handling system is 0.75.

47. Existing capacity of the container yard at this port can be estimated as about 1,800 TEUs.

48. According to the statistical data of Bitung branch office of PERSERO IV, the container handling volume at this port in 1991 is about 3,700 TEUs. Therefore, it seems that the capacity of this container yard is less than the volume actually handled. In this port, however, container handling is conducted not only in above container yard but also in other open spaces, so this port has enough capacity for container handling.

C. Required Scale of the Port Facilities

Cargo volume forecast

49. As shown in Table 5-4, a total of 2,119,000 tons of public cargo is forecast at the port of Bitung in 2000. Breaking down by packing type, general cargoes are 948,000 tons, solid bulk 603,000 tons, liquid bulk 35,000 tons, bag cargo 494,000 tons, and drum 40,000 tons.

Berthing facilities

1) Specialized container berth

(a) Container cargo

50. Out of the general cargo, 332,000 tons of cargo will be transported by containers in 2000. Container traffic data obtained at the port of Jakarta and Surabaya show that a stuffed 20-foot container is equivalent to about 10 tons. Container traffic at the port of Bitung in 2000 can be disaggregated and converted into TEUs.

51. Considering balance of numbers of incoming and outgoing containers, a total of 51,200 TEUs will be handled at the Bitung port in 2000 as shown below.

	Cargo Volume '000 ton	Stuffed (TEU)	Empty (TEU)
Export	11	1,100	0
Import	0		1,100
Domestic loading	76	7,600	16,900
Domestic unloading	245	24,500	0
Total container	332	33,200	18,000

(b) Container berth

52. In view of the considerable volume of containers as shown above, it will be appropriate that a special berth be constructed for handling containers. This specialized container berth will handle containers transported by full container vessels, and conventional berths will also handle containers transported by semi-container vessels.

53. Percentages of number of containers transported by the two types of vessels will be around 80 percent for the full container vessels and 20 percent for the semi container vessels at the port of Bitung in 2000. These percentage shares between the two types of container vessels are currently observed at Port of Ujung Pandang, and it is assumed that the same container traffic will be realized at the port of Bitung in 2000. Therefore, it is forecast that 266,000 tons of container cargoes will be handled at the specialized container berth.

54. Most of the containers or geetainers currently handled at the port of Bitung are coming from and going to Jakarta or Surabaya. It is presumed that this tendency will not drastically change through the target year 2000 although it is hoped that the port of Bitung will be a port of international container traffic.

55. Figure 6-1 and Figure 6-2 show ship length distributions of domestic container fleet which called Port of Jakarta and Port of Surabaya for October 1992, respectively. Judging from these data, it is proposed that the new container berth should have a berth length of 130 m and a water depth of 7.5 m.

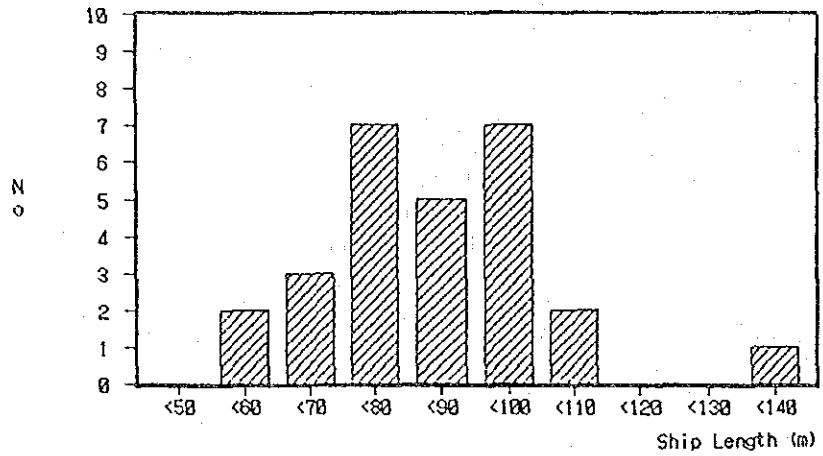


Figure 6-1 Distribution of Container Ship Length (Domestic) Tj.Priok

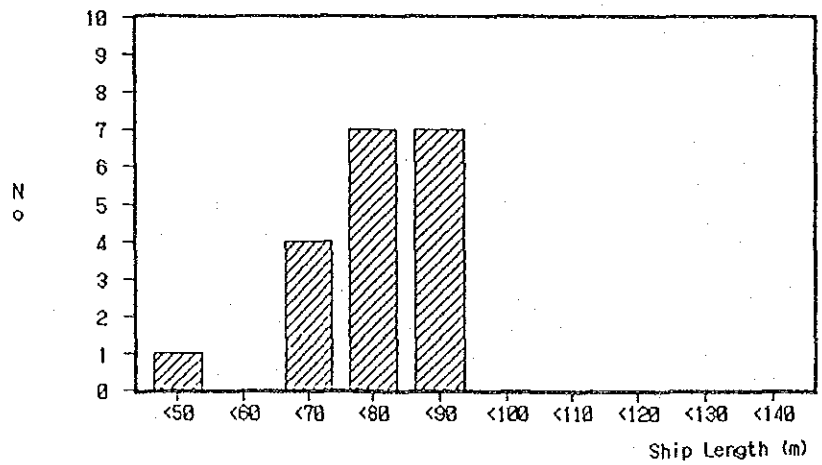


Figure 6-2 Distribution of Container Ship Length (Domestic) Surabaya

2) Bulk cement berth

(a) Bulk cement berth

56. Regarding solid bulk cargo, 267,000 tons of cement will be transported by cement bulk carriers, and their packing type will be changed into bags through a packing plant at the port to be distributed to markets in the province.

57. A specialized berth for cement bulk carriers should be constructed in order to handle the anticipated volume of cement in 2000. A cement packing plant will be constructed at the back of the berth by Semen TONASA.

58. Semen TONASA has a plan to transport the bulk cement to Bitung by 5,000 DWT class carriers. Table 6-1 shows distribution of ship length of some of the 5,000 DWT class bulk cement carriers. Required quay length for 5,000 DWT class cement bulk carriers is estimated at 130 m, and water depth alongside will be 7.5 m.

Table 6-1 Particulars of Selected Cement Bulk Carriers

No.	Ship Length (m)	DWT	Max Draft (m)
1	99.50	4,725.80	6.50
2	92.45	4,193.80	6.19
3	92.00	3,861.09	5.89
4	83.35	3,970.72	6.17
5	91.30	3,801.53	5.42
6	91.30	3,772.86	5.40
7	84.87	3,485.67	5.66
8	85.00	4,477.72	6.76
9	80.94	4,381.15	6.51
Ave.	88.97	4,074.48	6.06

Source: Ship call record

(b) Berth occupancy rate

59. About five days will be required to unload bulk cement from a 5,000 DWT class carrier. Consequently, a berth will be occupied by bulk cement carrier for 267 days a year, and resultant Berth Occupancy Rate will be about 75 percent.

3) Conventional berth

60. Taking both volume of the container cargoes handled at the specialized berth and volume of the bulk cement handled at the bulk cement berth from the total cargo volume, 1,586,000 tons of cargo should be handled at conventional berths, i.e., Oceangoing wharf and Interisland wharf.

61. As discussed in Section B, Chapter 6, the optimum berth capacity of the conventional berths, which consist of a 605 m long oceangoing quay, a 146 m long chemical berth, and a 502 m long interisland quay, is estimated at 1,528,000 tons under three-shift cargo operation.

62. The existing conventional berths will be able to handle the anticipated traffic because difference between the two figures above is negligible although improvement of gang productivity is desired.

4) Summary of berthing facility

63. 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.

64. 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.

65. Cargo allotment by wharf in 2000 can be 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)

Storage facility

66. Port of Bitung in 2000 will require the following public storage facilities. On the other hand, for the warehouses, it is planned to leave their construction and operation in the hands of private companies with only the required land secured in this port area.

a) Transit shed
b) Open storage
c) Container yard
d) Container freight station (CFS)

1) Transit shed

67. In general, the required area of a transit shed is calculated by the formula shown in Appendix 6-3.

68. In this study, some of the factors were based on the future practices in 2000 at this port. It was assumed that the future practices in 2000 at this port are at the same level as the present practices of the advanced ports in Indonesia like Tj.Priok, Surabaya, Uj.Pandang, etc..

69. Annual cargo handling volume through transit shed is 393,000 tons in 2000. Here, it is assumed that 25 % of the cargo (excluding the cargoes which will be handled at the new cement berth and the new container berth) will transit the sheds. The dwelling time is 3 days and the operating days are 320 days per year. On the other hand, the peak ratio is 1.3, the effective storage area ratio is 0.6 and the volume of cargoes per unit area is 1.5 tons/m^2.

70. The required area of the transit shed for port traffic in the year 2000 can be estimated as about 5,300 m^2.

71. The present area of the transit sheds in 1992 is 12,960 m^2. Therefore, it seems that an additional transit shed is not necessary in 2000.

2) Open storage

72. The required area of open storage is also calculated by the same formula. Annual cargo handling volume through open storage is 393,000 tons in 2000. Here, it is assumed that 25 % of the cargo (excluding the cargoes which will be handled at the new cement berth and the new container berth) will transit the open storage. The dwelling time is 5 days and the operating days are 320 days per year. On the other hand, the peak ratio is 1.3, the effective storage area ratio is 0.6 and the volume of cargoes per unit area is 1.5 tons/m^2.

73. The required area of the open storage for port traffic in the year 2000 can be estimated as about 8,900 m^2.

74. The present area of the open storage in 1992 is 15,500 m^2. Therefore, it seems that an additional open storage is not necessary in 2000.

3) Container yard

75. In general, the area of a container yard is determined by the number of ground slots and the layout of ground slots which depends on container handling method. The required number of ground slots is calculated by the formula shown in Appendix 6-4.

76. In this study, some of the factors were based on the future practices in 2000 at this port. Port of Bitung will handle container cargoes at two area in 2000. One is the existing area and the other is the new development area. The conventional vessels which carry the container cargoes call the existing wharves and the container vessels call the new container berth. It was assumed that the future practices in 2000 at the existing wharves are at the same level as the present practices at this port and that of new berth is at the same level as the present practices at Uj.Pandang.

77. The container handling volume in 2000 is 51,100 TEUs in total. It is assumed that the existing wharves will handle 20% of the container cargoes (10,220 TEUs) and 80% of the container cargoes (40,880 TEUs) will be handled at the new container berth. As regards the container handling system, it is assumed that the handling system at the existing wharves will be the same as at present and the handling system at the new container berth will be "Reach stacker crane (Top lifter) system".

(a) Existing wharves area

78. The dwelling time is 7 days and the operating days are 320 days per year. The peak ratio is 1.3 and the average stacking height is 2 stacks. On the other hand, the dwelling time of empty containers is 10 days and the operating days are 320 days. The peak ratio is 1.3 and the average stacking height is 2.5 stacks.

79. The required number of ground slots at the container yard in the year 2000 can be estimated as follows;

Stuffed container : Ns = 94
Empty container : Ns = 58

80. To arrange above ground slots, this port will require about 9,000 m^2 of container yard in 2000.

81. Port of Bitung has 4,000 m^2 of container yard (paved concrete blocks) and about 6,000 m^2 of open storage area at present, so, it seems that an additional area for container yard is not necessary in 2000.

(b) New container terminal area

82. The dwelling time is 7 days and the operating days are 350 days per year. The peak ratio is 1.3 and the average stacking height is 2.5 stacks. On the other hand, the dwelling time of empty containers is 10 days and the operating days are 350 days. The peak ratio is 1.3 and the average stacking height is 3.5 stacks.

83. The required number of ground slots at the container yard in the year 2000 can be estimated as follows;

Stuffed container : Ns = 263
Empty container : Ns = 153

84. To arrange above ground slots, this port will require about 15,000 m^2 of container yard in 2000.

4) Container freight station (CFS)

85. The new container terminal area will play a major role in container cargo handling at this port. Therefore, CFS and other facilities which are related to container cargo handling will be required in 2000.

86. In general, the required area of a CFS is calculated by the formula shown in Appendix 6-5.

87. Annual cargo handling volume of containerized cargo through CFS is 63,000 tons in 2000. Here, it is assumed that 25% of container cargoes (excluding reefer containers) which will be handled at the new container terminal area will transit the CFS in 2000. The dwelling time at CFS is 5 days and the operating days are 350 days per year. On the other hand, the peak ratio is 1.3, the utilization rate of CFS floor is 0.5 and the volume of cargoes per unit area is 1.3 tons/m^2.

88. This port will require an area of about 1,800 m^2 for the new CFS at the new container terminal area in 2000.

Other facilities at the new container terminal area

89. In general, a container terminal requires terminal office, maintenance shop, fumigation yard, washing and cleaning yard, custom inspection yard, etc.. These facilities can not be calculated by the formula. Therefore, the required area is estimated based on the standard scale of port facilities. The required area is 2,500 m^2 at the new container terminal area.

Passway along Interisland Wharf

90. It is expected that semi-container ships will continue to utilize Oceangoing Wharf to load/unload containers because these ships usually also load/unload conventional cargoes. Using Oceangoing Wharf can avoid berth shifting for semi-container vessels.

91. Traffic of containers between container yards at Specialized Container Berth and Oceangoing Wharf will be generated. Some of the containers which were unloaded at Oceangoing Wharf may be shipped from Specialized Container Berth, and vice versa.

92. 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.

D. Access Roads

General

93. It is thought that present road conditions around the project site which is proposed as the new container terminal and the new Bulk Cement Berth are poor. Therefore, a new access road will be required when the above port facilities start operation.

94. 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. As the future road area belongs to PERSERO, there is no need to purchase above land.

95. The total length of the access road is 810 m in case of above route.

Determination of traffic volume

96. In general, a design traffic volume can be calculated by the aforementioned formula refer to Appendix 6-6.

97. In this case, the target cargoes will be generated by operating the new container terminal and the new Bulk Cement Berth. So annual handled cargo volume is 517,000 tons/year. On the other hand, the share by vehicles is 1.0, the monthly variation is 1.5, the daily variation is 1.1, the truck real loadage is 10 tons, the real load rate is 0.5, the related vehicle rate is 0.5 and the hourly variation is 1.1. Here, above factors are based on the future land traffic activities in 2000.

98. The required design traffic volume can be estimated as 72 vehicles/hour in 2000. So daily new port area generated traffic volume is about 1,700 vehicles.

Road plan

99. Taking the speciality of vehicles using inner port roads and the convenience of parking into consideration, two lanes are proposed. Figure 6-3 shows the standard section of the road.

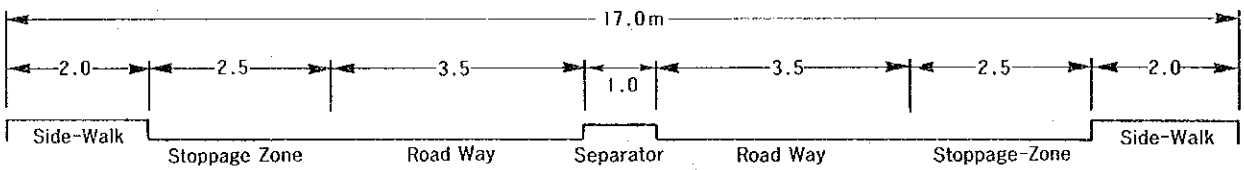


Figure 6-3 Standard Section of Access Road

Parking area for container land traffic

100. In operating the new container terminal, land vehicles related to container cargoes will be generated. Above land traffic will consist of trailers and related vehicles. When the container cargoes are handled at the new container berth, these vehicles will have to wait at the container yard or on the road. Thus, traffic jams will occur.

101. To reduce the traffic jams, a parking area will be required near the new container terminal. The required parking area is calculated as follows;

* The volume of land traffic is estimated at 37 vehicles/hour
* The required parking area per vehicle is 92.5 m^2

102. This port will require an area of about 3,500 m^2 for the parking area near the new container terminal in 2000.

E. Site Selection for the Port Development

103. Taking into consideration that Bitung municipality is the center of industrial activities in North Sulawesi province, construction site of the required port facilities will be evaluated and selected among the possible sites in the vicinity of the present Port of Bitung.

104. Prior to the present study, JICA implemented a feasibility study on 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. Those six possible sites are shown in Figure 6-4. After careful examination, Bitung East was selected as the most suitable site for the new port facilities by the year 2000.

105. 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. The following is a summary of the evaluation of the possible sites.

106. Batu-Angus The land behind the site in Batu-Angus is designated as a bird and animal conservation zone, and this area requires a breakwater to secure calm water basin. This land is not suited for a new port.

107. Bitung North This site is well shielded by Lembeh and very calm but steep hills exist behind the coastline and the sea bottom is also steep so that obtaining suitable port area and constructing a wharf would be costly. Thus, this site is not appropriate for port construction.

108. Bitung East This area is located next to the existing port facilities where deep and calm water area is found. This site is advantageous for the realization of efficient port management and operation. Bitung East is the most suitable site for the new port facilities by the year 2000.

109. Bitung West This site would be excellent as a site for new port construction after Pertamina is removed. Relocation of the Pertamina facilities before 2000, however, is unrealistic because these facilities are not deteriorated. In

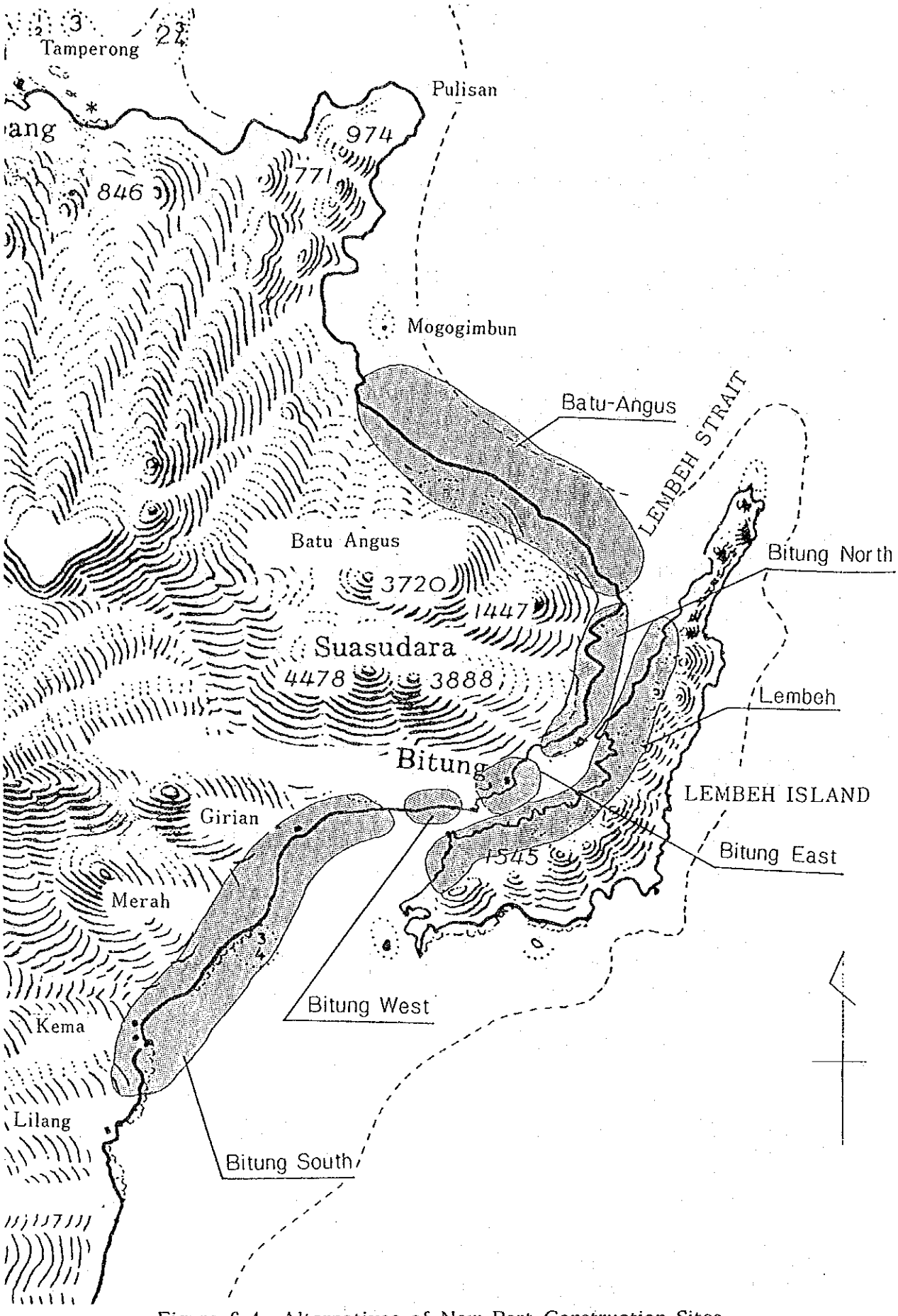


Figure 6-4 Alternatives of New Port Construction Sites

addition, this area is affected by waves and littoral drift, possibly posing some problems for a new port site.

110. Bitung South A breakwater and probably excavation will be required for securing the calm basin at this site. High construction costs are expected and this is a critical disadvantage.

111. Lembeh Lembeh has the advantage of a calm water surface everywhere, and seems to offer no problem in finding proper land for reclamation. The greatest disadvantage is the presence of Lembeh Strait which is 600 m wide at its narrowest point with some current.

F. Preparation of Alternative Layout Plans

Required facilities

112. As mentioned above, Bitung port will require the following port facilities in 2000.

(1) Specialized Container Berth : 130 m (-7.5 m)
(2) Bulk Cement Berth : 130 m (-7.5 m)
(3) Container yard :15,000 m^2 (excluding roads in the container terminal)
(4) Container freight station (CFS): 1,800 m^2
(5) Other facilities in the container terminal: 2,500 m^2
(6) Parking area for container land traffic: 3,500 m^2
(7) Roads in the container terminal
(8) Access road: Length 810 m, Width 17 m

Alternative layout plans

113. Layout plan of the Bulk Cement Berth is based on the location of the cement packing plant which was already planned. The Bulk Cement Berth is closely related with the cement packing plant, so, the berth should be located in front of the plant. Furthermore, the Interisland Wharf should not be divided by the Bulk Cement Berth, because of the adequate usage of the berths.

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

Alternative 1 : This alternative is based on an idea to continue operating the existing Local Wharf. The require area for container terminal is practically secured in the existing reserved area. The layout plan is shown in Figure 6-5.

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. The layout plan is shown in Figure 6-6.

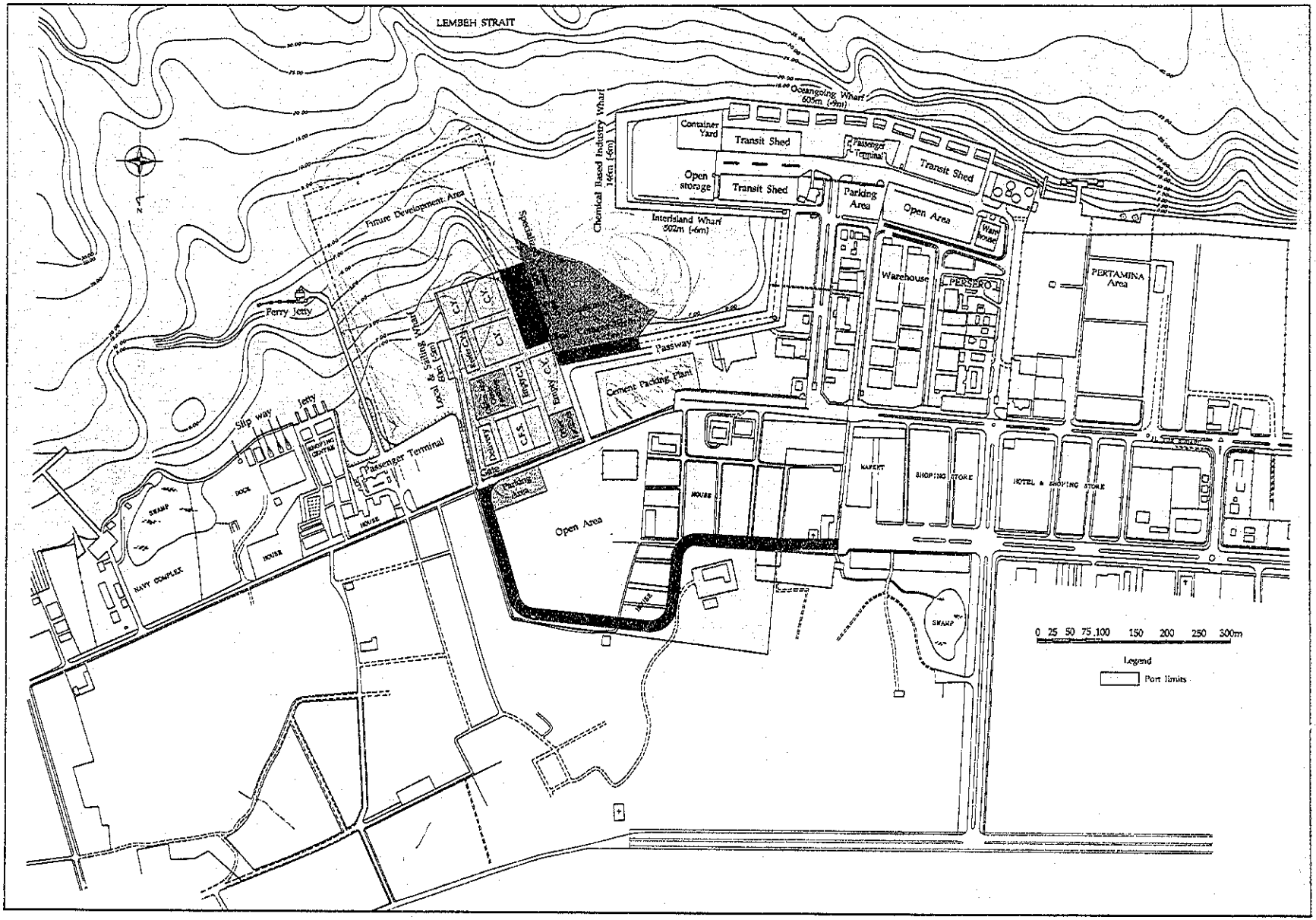


Figure 6-5 Bitung Port Development (Alternative 1)

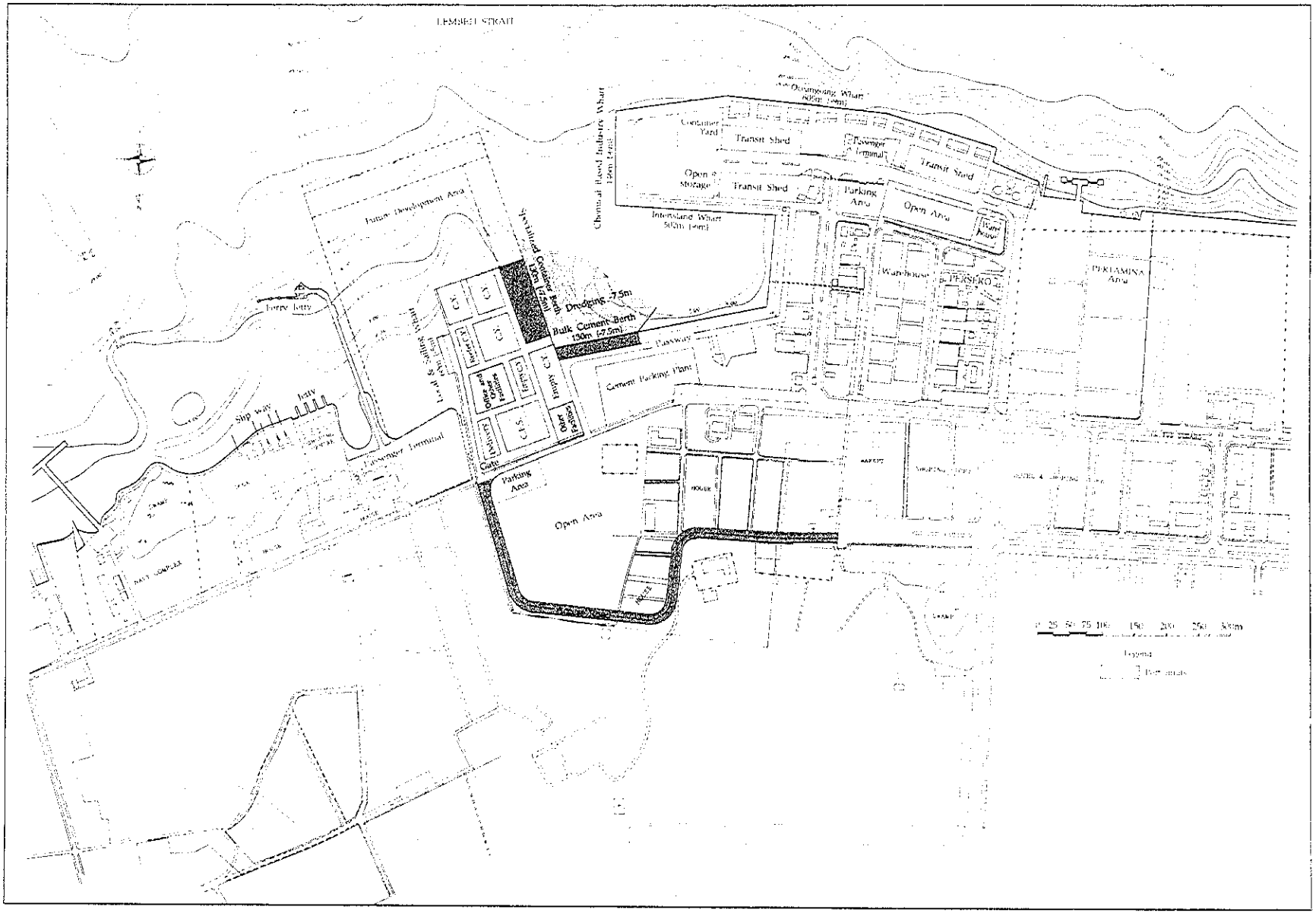


Figure 6-5 Bitung Port Development (Alternative 1)