Fig. 6-1 MAP OF DEVELOPMENT POTENTIAL

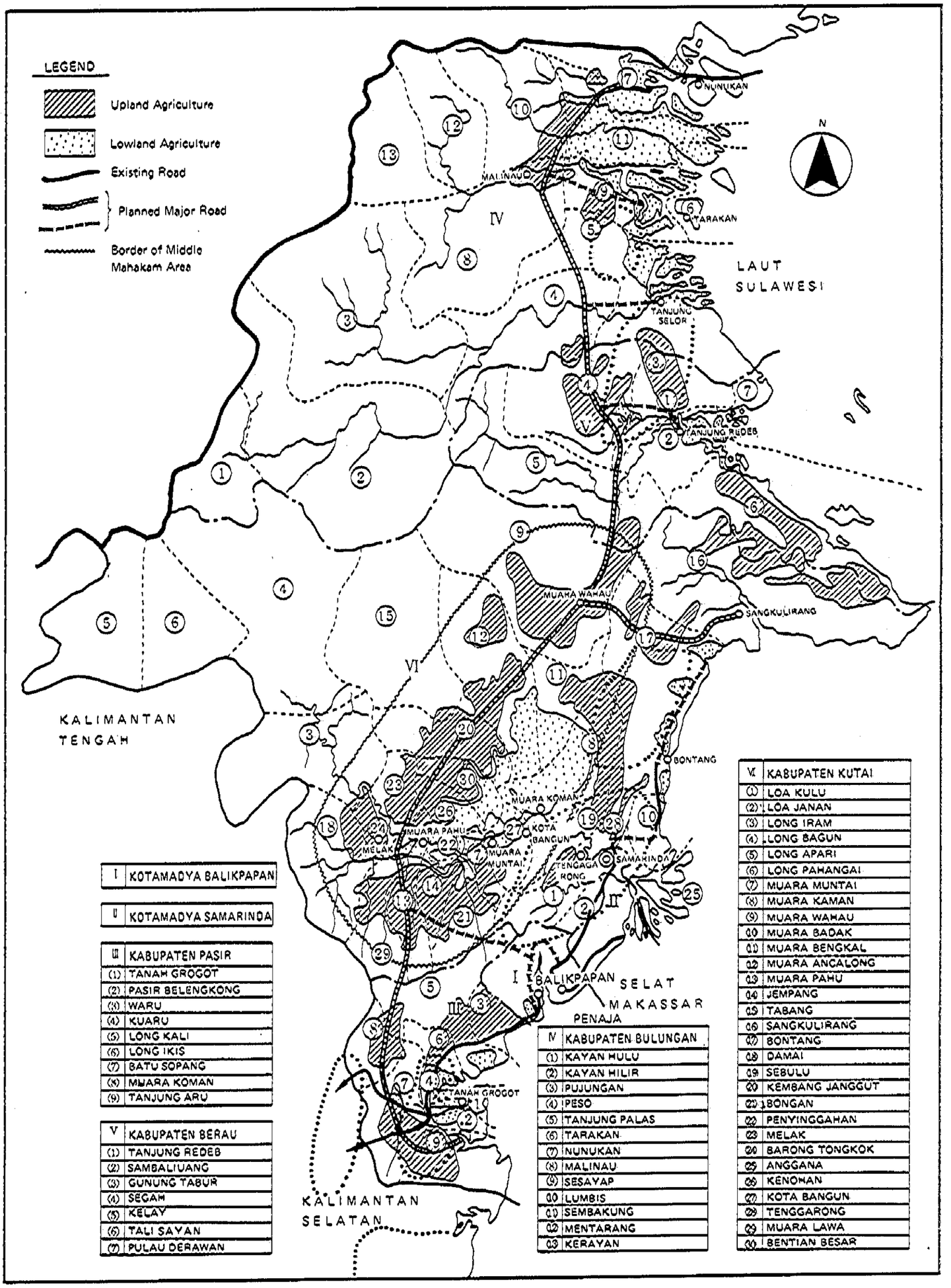


Table 6-12 Harvested Area of Food Crops, Indonesia

(Unit: Km²)

Province	Wetland Paddy				Dryland Paddy			
	1971	1976	1976/1971	AAGR (%)	1971	1976	1976/1971	AAGR (%)
Java & Madura	40,501	42,189	1.04	0.8	3,651	2,459	0.68	–
Sumatera	13,957	14,712	1.05	1.1	5,877	4,393	0.75	–
Kalimantan	4,702	5,401	1.15	2.8	2,388	2,264	0.95	–
Sulawesi	6,034	6,229	1.03	0.6	1,251	945	0.76	–
Maluku & Irian Jaya	10	9	0.9	–	102	233	2.28	18.0
Bali & Nusatenggara	3,724	3,723	1.00	–	1,037	1,049	1.01	0.2
Total of Outer Java	28,427	30,074	1.06	1.1	10,655	8,884	0.83	–
Indonesia	68,928	72,263	1.05	1.0	14,316	11,314	0.79	–

Province	Maize				Cassava			
	1971	1976	1976/1971	AAGR (%)	1971	1976	1976/1971	AAGR (%)
Java & Madura	18,581	14,177	0.76	–	11,010	10,030	0.91	–
Sumatera	1,285	887	0.69	–	945	1,302	1.38	6.6
Kalimantan	147	129	0.88	–	327	310	0.95	–
Sulawesi	3,432	3,106	0.91	–	756	729	0.96	–
Maluku & Irian Jaya	178	216	1.21	4.0	163	216	1.33	5.8
Bali & Nusatenggara	2,642	2,122	0.80	–	860	975	1.13	6.0
Total of Outer Java	7,655	6,460	0.84	–	3,051	3,531	1.16	3.0
Indonesia	26,266	20,637	0.79	–	14,061	13,562	0.96	–

Province	Sweet Potatoes				Peanuts			
	1971	1976	1976/1971	AAGR (%)	1971	1976	1976/1971	AAGR (%)
Java & Madura	3,148	2,608	0.81	–	2,965	3,145	1.06	1.2
Sumatera	493	407	0.83	–	182	324	1.78	1.5
Kalimantan	45	52	1.16	2.9	20	51	2.55	21.0
Sulawesi	281	259	0.92	–	289	307	1.06	1.2
Maluku & Irian Jaya	348	363	1.04	0.9	44	37	0.84	–
Bali & Nusatenggara	653	512	0.78	–	258	244	0.95	–
Total of Outer Java	1,820	1,594	0.88	–	792	964	1.22	4.0
Indonesia	3,569	3,002	0.84	–	3,758	4,109	1.09	1.8

Province	Soya beans				Total			
	1971	1976	1976/1971	AAGR (%)	1971	1976	1976/1971	AAGR (%)
Java & Madura	5,815	4,556	0.85	–	84,281	78,425	0.93	–
Sumatera	255	516	2.02	15.0	22,995	22,541	0.98	–
Kalimantan	18	37	2.06	16.0	7,647	8,244	1.08	1.5
Sulawesi	54	113	2.09	16.9	12,097	11,658	0.97	–
Maluku & Irian Jaya	3	3	1.00	–	845	1,077	1.27	4.9
Bali & Nusatenggara	652	707	1.08	1.6	9,826	9,332	0.95	–
Total of Outer Java	981	1,377	1.40	7.0	53,411	52,854	0.99	–
Indonesia	6,796	6,362	0.94	–	137,694	131,309	0.95	–

Note: AAGR — Average Annual Growth Rate
Source: Statistical Yearbook of Indonesia, 1976

Table 6-13 Production of Food Crops, Indonesia

(Unit: 1,000 tons)

Province	Wet Land Paddy				Dry Land Paddy			
	1971	1976	1976/1971	AAGR (%)	1971	1976	1976/1971	AAGR (%)
Java & Madura	15,675	17,618	1.12	2.4	554	460	0.83	–
Sumatera	4,654	5,668	1.22	4.0	905	775	0.86	–
Kalimantan	906	1,259	1.39	6.8	276	353	1.28	5.0
Sulawesi	1,947	2,271	1.17	3.1	181	149	0.82	–
Maluku & Irian Jaya	3	2	0.67	–	13	22	1.69	11.0
Bali & Nusatenggara	1,123	1,454	1.30	5.4	355	471	1.10	1.9
Total of Outer Java	8,633	10,664	1.23	4.3	1,531	1,470	0.96	–
Indonesia	24,308	28,282	1.16	3.1	2,084	1,930	0.93	–

Province	Maize				Cassava			
	1971	1976	1976/1971	AAGR (%)	1971	1976	1976/1971	AAGR (%)
Java & Madura	1,883	1,823	0.97	–	8,075	9,152	1.13	2.5
Sumatera	180	104	0.58	–	911	1,372	1.51	8.5
Kalimantan	11	11	1.00	0	288	273	0.95	–
Sulawesi	282	343	1.22	4.0	659	694	1.14	2.6
Maluku & Irian Jaya	15	22	1.38	6.6	126	189	1.50	8.5
Bali & Nusatenggara	235	209	0.89	–	650	787	1.16	3.0
Total of Outer Java	723	689	0.95	–	2,615	3,315	1.27	4.8
Indonesia	2,607	2,512	0.96	–	10,689	12,467	1.17	3.1

Province	Sweet Potato				Peanut			
	1971	1976	1976/1971	AAGR (%)	1971	1976	1976/1971	AAGR (%)
Java & Madura	947	1,171	1.24	4.3	224	255	1.14	2.6
Sumatera	315	348	1.10	2.0	18	31	1.72	11.0
Kalimantan	25	34	1.36	6.3	2	4	2.00	15.0
Sulawesi	158	170	1.08	1.5	20	19	0.95	–
Maluku & Irian Jaya	293	343	1.17	3.2	3	2	0.67	–
Bali & Nusatenggara	474	351	0.74	–	17	21	1.24	4.4
Total of Outer Java	1,265	1,247	0.99	–	60	77	1.28	5.1
Indonesia	2,212	2,417	1.09	1.8	284	332	1.17	3.1

Province	Soya beans				Total			
	1971	1976	1976/1971	AAGR (%)	1971	1976	1976/1971	AAGR (%)
Java & Madura	452	380	0.84	–	27,810	30,859	1.11	2.1
Sumatera	17	43	2.53	20.0	7,000	8,341	1.19	3.6
Kalimantan	1	2	2.00	15.0	1,509	1,936	1.28	5.1
Sulawesi	4	3	1.35	11.0	3,201	3,653	1.14	2.7
Maluku & Irian Jaya	0	0	0	0	454	580	1.28	5.0
Bali & Nusatenggara	41	48	1.17	3.2	2,725	3,051	1.12	3.6
Total of Outer Java	64	102	1.59	9.8	14,891	17,564	1.18	3.4
Indonesia	515	480	0.93	–	42,699	48,420	1.13	2.5

Source: Statistical Yearbook of Indonesia, 1976
Note: AAGR — Average Annual Growth Rate

Table 6-14 Production of Food Crop in East Kalimantan, 1976

Commodity	Production (t)	Per Capita Production (kg/year)	Per Capita Consumption in Indonesia (kg/year)	Remarks
Wetland paddy	62,000			
Dryland paddy	55,000			
Total	117,000			
				[conversion to milled rice]
(Milled Rice)	57,200	59.5	115.6	general loss = 0.94, 117,000x0.94x0.52=57,200
				milling loss = 0.52
Cassava	40,900	42.6	59.5	including cassava flour
Maize	2,600	2.71	25.7	including maize (tender)
Sweet potatoes	7,800	8.12	17.4	
Soyabeans	860	0.89	4.07	
Peanuts	590	0.61	1.84	shelled nuts

Source: (1) Data on East Kalimatan, 1976/77
(2) Statistical Pocketbook, 1976

Note: (1) Population of East Kalimantan in 1976 was 961 x 1,000
(2) Per capita consumption in Indonesia was as of 1974.

Table 6-15 Food Balance Sheet, Indonesia (1974)

Commodity		kg. per year	g. per day	Calories per day (cal)	Proteins per day (g)	Fat per day (g)
CEREALS	Wheat flour	4.90	13.42	47	1.6	0.2
	Rice milled	115.64	316.82	1,140	21.2	2.2
	Rice bran	5.88	16.10	63	1.6	2.4
	Maize	20.69	56.68	202	5.4	2.5
	Maize (tender)	5.00	13.70	49	1.3	0.6
	Sub-Total			1,501	31.1	7.9
STARCHY FOOD	Sweet potatoes	17.42	47.74	46	0.6	0.1
	Cassava	59.08	161.86	176	1.5	0.3
	Cassava flour	0.42	1.16	4	–	–
	Sago flour	4.05	11.10	39	0.2	0.1
	Sub-Total			265	2.3	0.5
SUGAR	Refined sugar	7.96	21.79	84	–	–
	Sugar cane	4.76	13.03	44	–	–
	Sub-Total			128	–	–
PULSES, NUTS, SEEDS	Ground nuts (shelled)	1.84	5.04	27	1.2	2.2
	Soyabeans	4.07	11.14	37	4.2	2.0
	Coconuts (in husk)	17.78	48.72	55	0.7	5.1
	Sub-Total			119	6.1	9.3
FRUITS	Bananas	20.81	57.01	40	0.5	0.2
	Pine apples	0.95	2.60	1	–	–
	Others	14.54	39.83	16	0.3	0.3
	Sub-Total			57	0.8	0.5
VEGETABLES	Potatoes	1.17	3.21	2	–	–
	Others	16.66	45.63	10	0.6	0.1
	Sub-Total			12	0.6	0.1
MEAT	Cattle – meat	1.45	3.97	9	0.8	0.6
	– offals	0.22	0.60	1	0.1	–
	Baffalo – meat	0.39	1.07	1	0.2	–
	– offals	0.09	0.26	–	–	–
	Goat – meat	0.09	0.26	–	–	–
	– offals	0.02	0.06	–	–	–
	Sheep – meat	0.08	0.21	1	–	0.1
	– offals	0.02	0.06	–	–	–
	Pig – meat	0.31	0.86	4	0.1	0.4
	– offals	0.03	0.09	–	–	–
	Poultry – meat	0.39	1.07	2	0.1	0.2
	– offals	0.04	0.11	–	–	–
	Meat product	0.02	0.06	–	–	–
	Sub-Total			18	1.3	1.3
EGGS	Hen eggs	0.07	0.19	–	–	–
	Hen eggs improved	0.19	0.52	1	0.1	0.1
	Duck & Geese eggs	0.19	0.52	1	0.1	0.1
	Sub-Total			2	0.2	0.2
MILK	Cow – milk	0.45	1.22	1	–	–
	– improved	0.02	0.06	–	–	–
	– powder	0.22	0.60	3	0.2	0.2
	Sub-Total			4	0.2	0.2
FISH	Fresh water	2.99	8.19	9	1.5	0.2
	Marine	5.70	15.61	17	1.7	0.2
	Sub-Total			26	3.2	0.4
OIL	Ground nuts oil	0.07	0.19	2	–	0.2
	Copra oil	4.29	11.75	104	–	12.0
	Palm oil	0.55	1.50	13	–	2.0
	Sub-Total			119	–	14.2
FAT	Cattle fat	0.05	0.14	1	–	0.2
	Buffalo fat	0.02	0.05	–	–	–
	Goat & Sheep fat	–	–	–	–	–
	Pig fat	0.03	0.09	1	–	0.1
	Butter	0.04	0.11	1	–	0.1
	Sub-Total			3	–	0.4
GRAND TOTAL				2,254	45.8	35.0

Source: Statistical Pocketbook, Indonesia, 1976

Table 6-16 Intake of Calorie, Protein, Fat in Several Countries in Asia in 1974 (Per capita per day).

Name of Country	Total Intake of Calorie (Cal)	Rate of starch (%)	Protein			Fat (g)
			Total	Animal Origin	Rate of Animal Origin (%)	
Japan [1)]	2,474	51.7	79.4	36.3	45.7	61.5
Korea	2,471	81.4	75.3	15.8	21.0	22.8
China	2,392	76.5	63.9	12.9	20.2	33.3
Philippine	1,940	70.1	50.0	18.8	37.6	28.4
India	1,976	69.5	48.0	5.4	11.3	28.4

Source: "charts of the state of Japan" (1978)
1) 1976 Valve
2) Rate of Starch is the rate of calorie in starchy food (cereals, potato, starch) to Total Calorie.

For the import dependency of food crops, wheat is imported wholly, while milled rice is imported only about 10% of the domestic production. On the other hand, cassava is exported about 10% of the production as feed.

From the present situation and trend of the farm agriculture discussed in the foregoing with respect to both whole country and East Kalimantan, areas where the development is most expectable will be Kalimantan and Irian Jaya.

However, from the growth rate of 2.5% of the national production of food crops exceeding, although slightly, the growth rate of 2.1% of the population and from examination of the foodstuff balance sheet, it was considered that the improvement of the diet in Indonesia would be in reducing the weight of starchy foodstuff and enhancing the weights of protein and fat and thus that the basic policy for development of the farm agriculture in East Kalimantan toward 2000 would be placed on self-supporting.

By this, there may be expected a surplus for export depending on the structural change of diet.

Thus, upon the self-supporting base described in the above paragraph, the productions of food crops in East Kalimantan in 1985 and 2000 are estimated as below.

(1) Production of food crops in 2000

1) Rice milled

Assuming that the per capita consumption of milled rice will continue on the national average base of 1974, the required production of East Kalimantan is

115.6 kg/year x 3,530 x 10^3 = 408,000 tons

Converting to the base of paddy rice

408/(0.94 x 0.52) = 834,000 tons

Thus, the required production of paddy rice is 7.1 times of its production of 1976.

(Note 0.94 : waste rate; and 0.52: milling loss.)

Proportioning the production of paddy rice according to the ratio of dryland paddy and wetland paddy of East Kalimantan in 1976,

Dryland paddy: 834,000 tons x 55/117 = 392,000 tons;

and

Wetland paddy: 834,000 tons x 62/117 = 442,000 tons.

If the productions per hectare in 2000 are estimated as below from the national and provincial average values (Table 6-17)

Dryland paddy: 1.80 t/ha; and

Wetland paddy: 4.00 t/ha,

then, the required areas of cultivation in 2000 are

Dryland paddy: $392 \times 10^3 / 1.80 = 218 \times 10^3$ ha = 2,180 km^2;

and

Wetland paddy: $442 \times 10^3 / 4.00 = 111 \times 10^3$ ha = 1,110 km^2

2) Cassava

Assuming that the per capita consumption of cassava will continue on the national average base of 1974 (59.5 kg/year), the required production of East Kalimantan will be 59.5 x 1.1 x 3,530 x 10^3 = 231,000 tons. Then, it is required to produce as much as 5.7 times of the present production. It should be noted that the foregoing calculation takes a waste rate of 10% into consideration.

If the production per hectare in 2000 is assumed to be 10.0 t/ha from the national and provincial average values (Table 6-17), the required area of cultivation in 2000 is

231 x 10^3/10.0 = 23.1 x 10^3 ha = 230 km^2.

3) Maize

Assuming that the per capita consumption of maize will continue on the national average base of 1974 (25.7 kg/year), the required production of East Kalimantan will be 25.7 x 1.02 x 3,530 x 10^3 = 92,000 tons, and it is required to produce as much as 35.3 times of the present output. It should be noted that the foregoing calculation takes a waste rate of 2% into consideration.

If the production per hectare in 2000 is assumed to be 1.25 t /ha from the national and provincial average values of 1976 (Table 6-17), the required area of cultivation in 2000 is

92 x 10^3/1.25 = 73.6 x 10^3 ha = 740 km^2.

4) Sweet potatoes

Assuming that the per capita consumption of sweet potatoes will continue on the national average base of 1974 (17.4 kg/year), the required production of East Kalimantan will be 17.4 x 1.1 x 3,530 x 10^3 = 67,000 tons, if a waste rate of 10% is taken into consideration,

and thus it is required to produce as much as 8.6 times of the present output.

If the production per hectare in 2000 is assumed to be 9.0 t/year from the national and provincial average values of 1976 (Table 6-17), the required area of cultivation in 2000 is

$67 \times 10^3/9.0 = 7.4 \times 10^3$ ha = 70 km^2.

5) Soya beans

Assuming that the per capita consumption of soya beans will continue on the national average base of 1974 (4.07 kg/year), the required production of East Kalimantan will be 4.07 x 1.05 x 3,530 x 10^3 = 15,000 tons, if a waste rate of 5% is taken into consideration, and thus it is required to produce as much as 17.4 times of the present output.

If the production per hectare in 2000 is assumed to be 0.8 t/ha from the national and provincial average values of 1976 (Table 6-17), the required area of cultivations is

$15 \times 10^3/0.8 = 18.8 \times 10^3$ ha = 190 km^2.

6) Peanuts

Assuming that the per capita consumption of peanuts will continue on the national average base of 1974 (1.84 kg/year), the required production of East Kalimantan will be 1.84 x 1.05 x 3,530 x 10^3 = 7,000 tons, if a waste rate of 5% is taken into consideration, and thus it is required to produce as much as 11.9 times of the present output.

If the production per hectare in 2000 is assumed to be 0.9 t/ha from the national and provincial average values of 1976 (Table 6-17), the required area of cultivation is

$7 \times 10^3/0.9 = 7.8 \times 10^3$ ha = 80 km^2.

7) For the food crops, consumption as seeds, feeds for animals and for industrial use is conceivable in addition to the consumption as food of people, but the production for such consumption is not specifically counted because of the following reasons.

- Consumption for seeds is little.
- As feeds for animals, rice bran and other wastes are usable.
- In 2000, protein and fatty foods may have a higher weight so that there is a possibility of the consumption of starchy foods coming below the level of the requirement specified here.
- There will not be much industrial consumption.

8) As seen in Table 6-18 the area of cultivation of the food crops in 2000 is 4,600 km^2 which is the value approximately equal to the area of development for lowland agriculture (4,660 km^2).

Table 6-17 Production of Food Crops in East Kalimantan and Comparison of Productivity with Other Provinces (1976)

Crops	Production (t)	Harvested Area (Ha)	Productivity (t/Ha)			Province with Max. Productivity
			East Kalimantan	Indonesia	Max. Province	
Wetland Paddy	61,746	25,952	2.38	3.61	4.18	Java & Madura
Dryland Paddy	55,000	38,516	1.43	1.70	1.85	Java & Madura
Cassava	40,865	5,223	7.82	9.20	10.5	Sumatera
Maize	2,648	2,166	1.22	1.23	1.29	Java & Madura
Sweet Potatoes	7,809	1,347	5.80	8.10	9.50	Maluku & Irian Jaya
Soybeans	860	1,351	0.64	0.76	0.83	Sumatera
Peanuts	592	962	0.62	0.81	0.91	Sumatera
Total	–	75,543	–	–	–	

Source: (1) Data on East Kalimantan, 1976/77
(2) Statistical Yearbook of Indonesia, 1976

Table 6-18 Projected Production of Food Crops in East Kalimantan

Crops	1976		1985		2000		Average Annual Increase Rate of Production (%)
	Production (1,000t)	Harvested Area (Km^2)	Production (1,000t)	Harvested Area (Km^2)	Production (1,000t)	Harvested Area (Km^2)	
Wetland Paddy[1)]	61.75	260	129	357	442	1,110	8.5
Dryland Paddy[2)]	55.00	385	115	676	392	2,180	8.5
Cassava	40.87	52	78.3	85.1	231	230	7.5
Maize	2.65	22	10.1	82.1	92	740	16.0
Sweet Potatoes	7.81	13	17.5	21.6	67	70	9.4
Soyabeans	0.86	13	2.6	34.2	15	190	13.0
Peanuts	0.59	10	1.5	18.5	7	80	10.9
TOTAL		755		1,275		4,600	

Source: Estimated by the Study Team.
(1) Production in 1985 is calculated by using the Average Annual Increase Rate of Production
(2) 1) and 2) are based on unhulled rice.
(3) Productivity in 1985 is projected to be the Average productivity in 1976 in Indonesia.

(2) Balance of demand and supply of food crops in 1985

From Table 6-18, the production of wetland paddy and dryland paddy (paddy rice base) in 1985 is 129 + 115 = 244 thousand tons or, converting to the base of rice milled,
244 x 0.94 x 0.52 = 119 thousand tons.

That is, the self-suppliable quantity per capita is $119 \times 10^6 / 1.57 \times 10^6 = 75.8$ kg/year.

Assuming the per capita consumption in 1985 as 115.6 kg/year which is the level throughout of the country in 1974, the required import is $(115.6 - 75.8) \times 10^{-6} \times 1.57 \times 10^6 = 62.5$ thousand tons.

For the other crops, it was considered that they would be covered by the production in the area so that there would be no import from the outside of the area.

6-1-4 Projection of Estate Agriculture

At present, a detailed plan of PELITA-III for East Kalimantan is still in the course of work of the authorities of East Kalimantan with no specific data determined yet and the results of PELITA-II is not yet published.

Therefore, on this account, in estimating the production of estate crops in 2000, its projection is considered as set forth in the following;

With respect to the kinds of estate crops, it was assumed that the five kinds of crops now being cultivated, that is, rubber, coconut, cloves, pepper and coffee, would be cultivated continuously and have the output increased in the future and that the crops to be newly developed would be two kinds of palm oil and cocoa.

With respect to yearly expansion of the area of cultivation of the respective crops, the planned quantities in PELITA-II of East Kalimantan (Table 6-19) were taken into consideration, and it was assumed that the expansion would continue at a rate of 8,300 hectares every year until 2000.

In this case, the total area of estates in 2000 will be 2,330 km^2 which corresponds to 20% of the area of 11,530 km^2 which can be developed for upland agriculture in East Kalimantan so that there is still left an enough land for development.

Table 6-19 Estimated Extension to Harvested Area by Crop, East Kalimantan

Crops	Harvested Area 1976 (Ha)	Annual Extension of Harvested Area (Ha/year)	Estimated Harvested Area (Ha)		Estimated Harvested Area (Km^2)	
			1985	2000	1985	2000
Cloves	90	300	2,790	7,290	30	70
Coconut	17,370	2,000	35,370	65,370	350	650
Rubber	11,060	1,000	20,600	35,060	210	350
Pepper	1,440	500	5,940	13,440	60	130
Coffee	2,250	500	6,750	14,250	70	140
Palm Oil	not planted	3,000	27,000	75,000	270	750
Cocoa	not planted	1,000	9,000	24,000	90	240
TOTAL	32,210	8,300	107,450	234,410	1,080	2,330

Source: (1) Data on East Kalimantan 1976/77
(2) Pemerintah Daerah Propinsi Daerah Tingkat I Kalimantan Timur Repelita-II Tahun 1974/75 – 1978/79

Note: The Harvested Area of Cloves in 1976 of (1) is much different from the Planned Harvested Area of Cloves in 1976 of (2), but the Quantity of (1) is used in this table.

With respect to the productivity of the respective crops, it was found as the result of an investigation of the national average yields per hectare of Indonesia from 1971 to 1975 that the productions of palm oil and cocoa were increasing steadily but that the other crops remained approximately on the same level respectively. Thus, for palm oil and cocoa, the national average values of 1975 were taken, while for the other crops, the highest values during the foregoing period were taken (Table 6-20). Table 6-23 shows the past record of productivity of the respective crops in East Kalimantan for reference.

Table 6-20 Yield Rate of Estate Crops, Indonesia

(Unit: Kg/Ha)

Crops	1971	1972	1973	1974	1975
Cloves	112	137	196	87.4	68.5
Coconut	680	660	642	685	683
Rubber	344	349	365	356	345
Pepper	524	672	616	562	450
Coffee	446	457	396	414	427
Palm oil	1,780	1,880	1,860	2,136	2,400
Cocoa	129	120	135	199	228

Source: Made from Table 6-21 and Table 6-22.
Note: Cloves ——— Small Holders, dry products
Coconut ——— Esters + Small Holders, copra equivalent
Rubber ——— Estates + Small Holders, dry products
Pepper ——— Small Holders, dry products
Coffee ——— Estates + Small Holders, dry products
Palm oil ——— Esters + Small Holders, liquid
Cocoa ——— Esters + Small Holders, dry products

TAble 6-21 Production of Estate Crops, Indonesia

(Unit: 1,000t)

Crops	1971	1972	1973	1974	1975
Cloves[1)]	11.3	15.0	27.3	15.0	14.8
Coconut[2)]	1,283	1,259	1,287	1,444	1,505
Rubber[1)]	786	804	844	822	793
Pepper[1)]	26.7	30.8	28.5	27.5	22.9
Coffee[1)]	181	181	150	159	172
Palm oil	248	269	290	351	411
Cocoa	1.8	1.8	1.8	3.4	3.9

Note: 1) Dry products
2) Copra equivalent
Source Statistical Yearbook of Indonesia, 1976

Table 6-22 Harvested Area of Estate Crops, Indonesia

(Unit: 1,000 Ha)

Crops	1971	1972	1973	1974	1975
Cloves	100.9	109.1	139.6	171.6	216.0
Coconut	1,887	1,908	2,005	2,108	2,204
Rubber	2,287	2,306	2,312	2,308	2,296
Pepper	51.0	45.8	46.3	48.9	50.9
Coffee	405.5	395.9	379.1	384.1	402.9
Oil Palm	139.2	143.2	155.7	164.3	170.9
Cocoa	13.9	15.0	13.3	17.1	17.1

Source: Statistical Yearbook of Indonesia, 1976

Table 6-23 Yield Rate of Estate Crops, East Kalimantan

(Unit: kg/Ha)

Crops	1972	1973	1974	1975	1976
Cloves (Kg/Ha)	25	19	59	59	122
Coconut (Kg/Ha)	426	326	325	312	450
Rubber (Kg/Ha)	15	67	30	28	45
Pepper (Kg/Ha)	708	670	621	699	424
Coffee (Kg/Ha)	182	138	136	253	302

Note: Made from Table 6-24 and Table 6-25

Table 6-24 Production of Estate Crops, East Kalimantan

(Unit: t)

Crops	1972	1973	1974	1975	1976
Cloves	1.5	1.7	5.3	5.3	11.0
Coconut	5,970	6,120	6,370	6,200	7,810
Rubber	190	820	330	310	500
Pepper	850	750	870	1,000	610
Coffee	280	260	270	500	680

Source: Data on East Kalimantan, 1976/77

Table 6-25 Harvested Area of Estate Crops, East Kalimantan

(Unit: Ha)

Crops	1972	1973	1974	1975	1976	Share of Area by Crop (%)
Cloves (Ha)	60	90	90	90	90	0.3
Coconut (Ha)	14,010	19,070	19,620	19,900	17,370	53.9
Rubber (Ha)	12,890	12,200	11,090	11,140	11,060	34.3
Pepper (Ha)	1,200	1,120	1,400	1,430	1,440	4.4
Coffee (Ha)	1,540	1,890	1,990	1,980	2,250	7.0
TOTAL	29,700	34,370	34,190	34,540	32,210	99.9

Source: Data on East Kalimantan, 1976/77

Table 6-26 shows the estimated production of estate crops in 1985 and 2000, by multiplying the productivity of each crop in 1985 and in 2000 with the harvested area of each crop in 1985 and in 2000 shown in Table 6-19.

Export and domestic outward flow of estate crops in 1985 and in 2000 in East Kalimantan are estimated as follows. The per capita consumption of estate crops in East Kalimantan in 1985 and in 2000 is assumed to be the same as that of the present national average. (Table 6-27) By multiplying this per capita consumption with the population in 1985 and in 2000, the consumption in East Kalimantan for the respective years are obtained and by deducting this from the production shown in Table 6-26, the export and domestic outward flow is obtained. The results are given in Table 6-28.

Table 6-26 Estimated Production of Estate Crops, East Kalimantan

Crops	Production 1976 (t)	Yield Rate in 1985&2000 (kg/Ha)	Estimated Production (1000t)		Growth of Production	
			1985	2000	1985 / 1976	2000 / 1976
Cloves	11.0	190	0.6	1.3	54.5	118
Coconut	7,810	680	23.8	44.2	3.0	5.7
Rubber	500	360	7.6	12.6	15.2	25.2
Pepper	610	670	4.0	8.7	6.6	14.3
Coffee	680	450	3.2	6.3	4.7	9.3
Palm oil	no production	2,400	64.8	180	--	--
Cocoa	no production	220	2.0	5.3	--	--
TOTAL	9,611	.....	106.0	258.4	----	----

Source: Made from Table 6-19, Table 6-20 and Table 6-24.
Note: The maximum value of yield rate from 1971 to 1976 is used as the value in 1985 and 2000.

Table 6-27 Consumption of Estate Crops, Indonesia

(Unit: 1,000t)

Crops	Balance	1973~1975	Average Annual Domestic Consumption	Per Capita Annual Consumption (kg)
Rubber	Production	2,459		
	Export	2,519		
	Domestic Consumption	0	0	0
Copra 3)	Production	4,051 1)		
	Export	120 1)		
	Domestic Consumption	3,931	1,310	10.2
Coffee	Production	481		
	Export	341		
	Domestic Consumption	140	46.7	0.362
Palm oil	Production	1,052		
	Export	930		
	Domestic Consumption	122	40.7	0.316
Pepper	Production	78.9		
	Expot	55.8		
	Domestic Consumption	23.1	7.70	0.0597

Source: Made from Table 2-25 and Table 2-26.
Note: 1) Total of the value in 1972, 1973 and 1975.
2) Average population (129 x 10^6 people) from 1973 to 1975 is used.
3) Copra equivalent.

Table 6-28 Estimated Export Plus Domestic Outward Flow of Plantation Products, East Kalimantan

(Unit: 1,000t)

Crops	1985			2000		
	Production	Consumption	Export plus Domestic Outward	Production	Consumption	Export plus Domestic Outward
Cloves	0.6	-	0.6	1.3	-	1.3
Coconut	23.8	16.0	7.8	44.2	36.0	8.2
Rubber	7.6	-	7.6	12.6	-	12.6
Peppor	4.0	0.1	3.9	8.7	0.2	8.5
Coffee	3.2	0.6	2.6	6.3	1.3	5.0
Palm oil	64.8	0.5	64.3	180	1.1	178.9
Cocoa	2.0	-	2.0	5.3	-	5.3
TOTAL	106.0	17.2	88.8 (24.5)	258.4	38.6	219.8 (40.9)

Source: Made from Table 6-26 and Table 6-27.
Note: (1) The population in East Kalimantan is projected as follows:
1985 — $1,570 \times 10^3$
2000 — $3,527 \times 10^3$
(2) Palm oil is liquid cargo, and that is handled by tank and pipeline.
(3) The parenthesized figure in the line of thetotal shows the total of Dry Cargo.

6-1-5 Projection of Fishery

According to PELITA-II of East Klaimantan, the rate of growth of fishery production during the period of plan (1974 to 1978) is set at 4.5%. This is a plan far below the actual growth rate (annual average growth rate of 1974 to 1976 being 13.9%). Further, in a long ranging view, there is a restriction from the conservation of resources. Thus, the fishery production in the future is estimated upon the following consideration.

(1) During the period of 1976 to 1985, an intermediate value of the planned growth ate (4.5%) and the actual value (average 11.2% in 1972 to 1976) is taken, and thus a growth of 7.9% will be achieved.

(2) During the period of 1986 to 2000, it is assumed that the planned growth rate of PELITA-II or 4.5% will continue.

Upon the assumption in the above paragraph, the fishery production in the future is estimated as follows.

1985

$$58.4 \times 1.079^{9} = 58.4 \times 1.98 \doteq 116 \text{ (thousand tons)}$$

2000

$$116 \times 1.045^{15} = 116 \times 1.94 = 225 \text{ (thousand tons)}$$

For the consumption within the province, the national consumption of fishes (23.8 g/day), per capita per day planned consumption of East Kalimantan (100 g/day) and per capita per day consumption in Japan in 1976 (95.5 g/day) are taken for reference, while it is considered that there will be an increasing dependency on livestock products such as meat and dairy products. Thus, it is considered that the consumption will continue at the level of 100 g/day.

1985 (Consumption)

$$100 \times 365 \times 10^{-6} \times 1.57 \times 10^{6} \times 1/0.85 = 68 \text{ (thousand tons)}$$

(Waste rate 15% considered)

2000 (Consumption)

$$100 \times 365 \times 10^{-6} \times 3.53 \times 10^{6} \times 1/0.85 = 152 \text{ (thousand tons)}$$

Accordingly, reserve for foreign and domestic exports

1985 (foreign and domestic exports)

$$116 - 68 = 48 \text{ (thousand tons)}$$

2000 (foreign and domestic exports)

$$225 - 152 = 73 \text{ (thousand tons)}$$

Table 6-29 shows the above figures.

Table 6-29 Estimated Fishery Production, East Kalimantan

(Unit: 1,000t)

	1976	1985	2000
Production	58.4	116	225
Consumption	35.0	68	152
Export/Domestic Outward Flow	23.4	48	73

Source: Estimated by the Study Team

Note: (1) Fresh fish base

(2) The consumption in 1976 is the projected figure in the PELITA-II of East Kalimantan

6-1-6 Projection of Livestock Production

With respect to the production of livestock products in 2000, the provincial governmen has not formulated any concrete plan so that it is considered as follows.

With respect to eggs and milk, the production will be increased to achieve self-sufficiency.

For meat, the production will, of course, be improved but the per capita meat consumption in 1976 is as low as 3.15 g/day (calculated from Table 2-33) or about 1/3 of the national average of 8.68 g/day in 1974 (Table 6-15). On the other hand, the population will be increasing at a great rate. Therefore, it will be still equired in 2000 to import from the foreign countries and other areas in the country.

(1) Calculation of the shortage of meat in 1985

Assuming that the per capita meat consumption in 1985 will be raised up to the national level (1974), and taking consideration of the increasing population:

138 tons x 8.68/3.15 x 1,570/806 = 740 tons

(2) Calculation of the shortage of meat in 2000

Assuming that the per capita meat consumption in 1985 will be raised up to the level of D.K.I. Jakarta,in 1975 (30 g/day), and taking consideration of the increasing population:

138 tons x 30/3.15 x 3,530/806 = 5,740 tons

6-1-7 Projection of Forestry

(1) 1985

According to the provincial government of East Kalimantan, the maximum quantity of log to be felled in the province will be set at 11,000,000 m^3 a year for the protection of forest resources.

On the other hand, according to the Program Penegembangan sektor – Sektor Industri, the production of processed timber is projected to increase at an annual rate of 18.2% in PELITA II. In PELITA III, the ratio will be 25% a year. These rates are projected on a national basis, and it is conceivable that the rate for East Kalimantan where forest resources are found in abundance is somewhat higher.

As the production growth rate of processed timber in East Kalimantan, the national average percentage of 18.2% is hypothetically taken for 1979, and for the 1979 to 85 period, the growth rate of 30%, a little higher than the national average, is used.

Consequently, the output of processed timber in East Kalimantan in 1985 may be projected as follows:

538,000 m^3 x $(1 + 0.182)^3$ x $(1 + 0.30)^6$ = 4,288,000 m^3 (2,144,000 tons)

As it is expected that the provincial consumption and the exports to other provinces will increase in proportion to a rise in the level of the national life, it is hypothesized that the output will increase at an average GRDP growth rate excluding those of forestry and mining sector of 14.5%.

Provincial consumption: 7,000 m^3 x $(1 + 0.145)^9$ = 24,000 m^3 (12,000 tons)

Exports to other provinces: 460,000 m^3 x $(1 + 0.145)^9$ = 1,556,000 m^3 (778,000 tons)

Consequently, the exports of processed timber will be:

4,288,000 – (24,000 + 1,556,000) = 2,708,000 m^3 (1,354,000 tons).

On the other hand, the quantity of log for export to other provinces is hypothesized as depending on the demand of processed timber in other provinces and projected to increase at an annual rate of 14.5%. That is:

418,000 m^3 x $(1 + 0.145)^9$ = 1,414,000 m^3 (1,103,000 tons).

Therefore, the export of log will be:

11,000,000 – (4,288,000 + 1,414,000) = 5,298,000 m^3 (4,132,000 tons)

(2) 2000

The export of log to other provinces, provincial consumption of processed timber and the export of processed timber to other provinces are hypothesized as increasing at an annual rate of 6.3% from 1985 (i.e., the average GRDP growth rate from 1985 to 2000 excluding those of the forestry and mining sector. That is:

Export of log to other provinces:

1,414,000 m^3 x $(1 + 0.063)^{15}$ = 3,535,000 m^3 (2,727,000 tons)

Provincial consumption of processed timber:

24,000 m^3 x $(1 + 0.063)^{15}$ = 60,000 m^3 (30,000 tons)

Export of processed timber to other provinces:

1,556,000 m^3 x $(1 + 0.063)^{15}$ = 3,890,000 m^3 (1,945,000 tons)

Moreover, it is assumed that there will be no exports of log from the ports of Balikpapan and Samarinda and that only the exports of log, which are equivalent in quantity to those from ports other than Balikpapan and Samarinda will be left as they are. That is:

Exports of log: Exports of log in 1976 – exports of log from ports of Balikpapan and Samarinda in 1976 = 8,211,000 – 6,058,000 = 2,153,000 m^3

Therefore, the exports of processed timber will be:

11,000,000 – (2,153,000 + 3,535,000 + 60,000 + 3,890,000) = 1,362,000 m^3.

The above data are put into order as shown in Table 6-3o.

Table 6-30 Projection of Forestry in East Kalimantan

(Unit: 1,000 m^3 based on Log)

Year	Production of Log	Log			Processed Timber			
		Export	Domestic Outbound	Total	Export	Domestic Outbound	Consumption in East Kalimantan	Total
1976	9,167	8,211	418	8,629	71	460	7	538
1985	11,000	5,298	1,414	6,712	2,708	1,556	24	4,288
2000	11,000	2,135	3,535	5,688	1,362	3,890	60	5,312

(3) Method of calculation of the value added by timber processing
Yearly production of log and yearly GRDP of log's sector are shown in the Table 6-31.

Table 6-31 Production of Log and GRDP of Log's Sector in East Kalimantan

Production \ Year	1971	1972	1973	1974	1975	1976
Production of Log (10^3 m^3)	5,537	6,504	8.992	7,289	7,293	9,167
GRDP of Log's Sec. (10^3 US$)'s	197.3	231.8	320.5	257.8	259.9	326.7

Source: Data on East Kalimantan 1976/77
Note: Constant 1973 FOB Price = 35.64 US$/$m^3$

The method of calculation of the value added by timber processing is given as follows.
With the FOB price of processed timber taken as 90 US$/$m^3$, the value added of processed timber having the expense of processing facility (5.8 US$/$m^3$ in 8 years depreciation) and overhead expense deducted from said FOB price, is calculated as follows.

Processed timber price 90 US$/$m^3$ – Log cost 70 US$/$m^3$ (Yield rate 70%)
– Equipment investment 5.8 US$/$m^3$ – Overhead 2.4 US$/$m^3$ = 11.8 US$/$m^3$

Thus, the rate of the value added of timber processing is 27.8% per m^3 of material timber. Using the rate, the GDP of timber processing was calculated and incorporated in the manufacturing sector.

6-1-8 Projection of Fertilizer

The fertilizer plant in Bontang is now in the stage of construction. It was assumed that the plant would be in full operation at an annual capacity of 560,000 tons in 1984 and that the same level of production would continue until 2000.

6-1-9 Projection of Mining

(1) Oil

1) Oil refining

The Balikpapan Refinery Plant has a production capacity of 60,000 barrels per day. Now, seeing the outputs in the past, the year of 1977 showed a peak production which was corresponding to the capacity so that the GDP value of 1977 was calculated and was taken as a base. In PELITA III the productive capacity of this refinery plant is planned at 100,000 barrels per day. Thus, the additional output of 40,000 barrels for improvement of the capacity was included from 1986, while the composition of oil products was assumed to be the same with that in 1977, and it was taken that the production of 100,000 barrels per day would continue until 2000.

2) Crude oil

As it is very difficult to project future crude oil production, it is assumed in this study that the per capita GRDP in 1977, when the maximum crude oil production is achieved, will remain unchanged in 1985 and in 2000. This means that crude oil production increases in proportion to the growth of population. Table 6-32 shows the result of the calculation of the per capita GRDP of crude oil sector in 1977.

Table 6-32 GRDP and GRDP per capita of Crude Oil Sector in East Kalimantan

Item \ Year	1973	1976	1977
(1) Export volume of crude oil in Indonesia (Thousand ton)	49,438	59,268	67,086
(2) Export amounts of crude oil in Indonesia (Million US$)	1,383	5,652	?
(3) Population of Indonesia (Million persons)	126	135	?
(4) = (2)/(3) GDP per capita of crude oil sector in Indonesia at current price (US$)	11.0	41.8	?
(5) GDP per capita of crude oil sector in Indonesia at 1973 constant price (US$)	11.0	12.3	13.6
(6) Population of East Kalimantan (Million persons)	0.80	0.96	1.01
(7) = (5) x (6) GRDP of crude oil sector in East Kalimantan at 1973 constant price (Million US$)	8.8	11.8	13.7

Note: Derived from Statistical Yearbook of Indonesia, 1976/77 and the material of BAPPEDA, East Kalimantan

(2) Natural Gas

Natural gas in the area of East Kalimantan is gathered at Huffco/Badak where it is processed at an LNG plant into liquefied gas and has its whole amount exported. The production capacity was presently 2,000,000 tons/year (export volume was 650,000 tons in 1977), but it is planned to increase to 3,000,000 tons/year. Thus, it was assumed that in 1985 and 2000, there would be a production of 3,000,000 tons/year.

Natural gas burning presently at the respective oil fields or that upon discovery of new gas fields may be used for fertilizer and other chemical industries in Bontang and, in some case, for city gas. But, here, only the LNG plant was taken. The price was assumed to be 2.20 US$ per BTU/FOB.

Note: BTU = British Thermal Unit, 38.9×10^9 TU = 10^6 Nm^3 = 0.9×10^3 M/T = 9.8×10^9 Kcal

(3) Coal

In East Kalimantan, coal is produced but in a very small scale, and it is difficult to forecast its output under the present situation of any coal development that, may have an effect upon GRDP, is still in the stage of survey of deposits being made shortly. However, according to the plan of P.N. TAMBANG BATUBARA, the plan of thermo-electric power plant, scheduled to be supplied coals from East Kalimantan, is shown in the Table 6-33.

Table 6-33 The plan of thermo-electric power plant scheduled to be supplied coal from East Kalimantan

	1985 – 1986	1985 – 1986	1987 – 1988	1989 – 1990
Power Station Name	Pulau Suraya I, II (Singapore)	Port Kelang I, II (Malaysia)	Pulau Suraya III, IV (Singapore)	Pulau Suraya V, VI (Singapore)
Required Coal Volume (million ton per year)	2.10	1.80	2.10	2.10

Source: Overseas Coal Development Survey Report, 1978.

On the other hand, the mining areas to be developed hereafter extend over a wide range including (I) Tarakan Basin North, (II) Tarakan Basin South, (III) Eastern Kutei Basin North, (IV) Eastern Kutei Basin South, (V) Pasir Basin North and (VI) Pasir Basin South.
Thus, it was assumed that there would be a production of 2,000,000 tons/year in 2000.

6-2 Projection of Cargo Volume Handled in the Port of Balikpapan

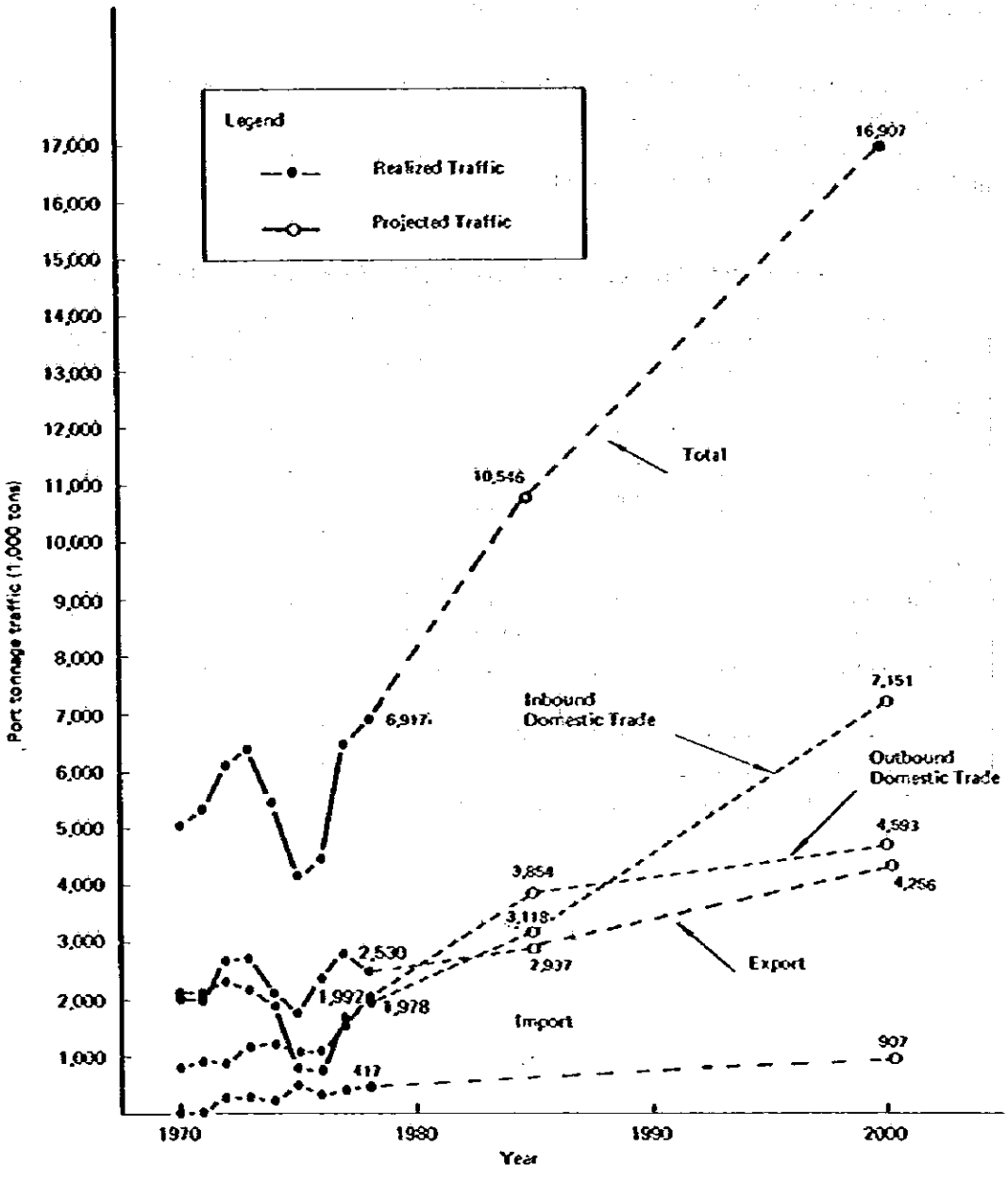
As shown in Table 6-34 and Fig. 6-2, the volume of cargo handled at the Port of Balikpapan is estimated at about 10.6 million tons (about 3.6 million tons as foreign trade, about 7 million tons as domestic trade) in 1985, and about 16.9 million tons (about 5.2 million tons as foreign trade, about 11.7 million tons as domestic trade) in 2000.

Table 6-34 Projection of Cargo Traffic through the Port of Balikpapan

Item	1976 (1,000tons)	1978 (1,000tons)	1985 (1,000tons)	2000 (1,000tons)	1985/1976	A.A.G.R.	2000/1976	A.A.G.R.
Foreign trade						%		%
Import	281	417	637	907	2.27	9.5	3.23	5.0
Export	2,348	2,530	2,937	4,256	1.25	2.5	1.81	2.5
Sub-Total	2,629	2,955	3,574	5,163	1.36	3.1	1.96	2.8
Domestic trade								
Inbound	730	1,978	3,118	7,151	4.27	17.5	9.80	10.0
Outbound	1,085	1,992	3,864	4,593	3.55	15.1	4.23	6.2
Sub-Total	1,815	3,970	6,972	11,744	3.84	16.1	6.47	8.1
Total	4,444	6,917	10,546	16,907	2.37	10.1	3.80	5.7

Note: A.A.G.R. — Average Annual Growth Rate

Fig. 6-2 Projected traffic in Balikpapan port



By commodity, in 1985, crude oil and petroleum products rank the highest in volume with 8,304 thousand tons, followed by timber with 1,477 thousand tons; by construction materials with 178 thousand tons, food stuffs with 116 thousand tons, machinery and vehicles with 114 thousand tons, estate crops with 113 thousand tons, fertilizer with 13 thousand tons and miscellaneous with 231 thousand tons.

In 2000, crude oil and petroleum products rank the highest with 14,022 thousand tons followed by timber with 1,079 thousand tons; and by construction materials with 500 thousand tons, estate crops with 286 thousand tons, machinery and vehicles with 222 thousand tons, food stuffs with 117 thousand tons, fertilizer with 45 thousand tons and miscellaneous with 636 thousand tons. (Table 6-35 and Table 6-36)

Table 6-35 Projection of cargo volume handled in the Port of Balikpapan by commodity (1985)

Unit: 1,000 ton (1000 m³)

Commodity Group	Foreign Trade			Domestic Trade			Total		
	Discharged	Loaded	Total	Discharged	Loaded	Total	Discharged	Loaded	Total
Food stuffs	63	–	63	15	38	53	78	38	116
Rice	63	–	63	–	14	14	63	14	77
Wheat flour	–	–	–	6	–	6	6	–	6
Sugar	–	–	–	8	–	8	8	–	8
Marine products	–	–	–	–	24	24	–	24	24
Miscellaneous	–	–	–	1	–	1	1	–	1
Estate crops	–	93	93	19	1	20	19	94	113
Construction materials	79	–	79	30	69	99	109	69	178
Machinery	49	–	49	17	26	43	66	26	92
Vehicles	15	–	15	3	4	7	18	4	22
Fertilizer	–	–	–	13	–	13	13	–	13
Wood	–	1,099	1,099	–	378	378	–	1,477	1,477
Logs	–	826 (1,060)	826 (1,060)	–	221 (283)	221 (283)	–	1,047 (1,343)	1,047 (1,343)
Processed timber	–	271	271	–	156	156	–	427	427
Other wood products	–	2	2	–	1	1	–	3	3
Oil	354	1,715	2,069	2,917	3,318	6,235	3,271	5,033	8,304
Crude oil	–	1,680	1,680	2,917	–	2,917	2,917	1,680	4,597
Petroleum products	354	35	389	–	3,318	3,318	354	3,353	3,707
Miscellaneous	77	30	107	104	20	124	181	50	231
Total	637	2,937	3,574	3,118	3,854	6,972	3,755	6,791	10,546

Table 6-36 Projection of cargo volume handled in the Port of Balikpapan by commodity (2000)

Unit: 1,000 ton (1000 m^3)

Commodity Group	Foreign Trade			Domestic Trade			Total		
	Dis-charged	Loaded	Total	Dis-charged	Loaded	Total	Dis-charged	Loaded	Total
Food stuffs	–	–	–	80	37	117	80	37	117
Rice	–	–	–	–	–	–	–	–	–
Wheat flour	–	–	–	30	–	30	30	–	30
Sugar	–	–	–	44	–	44	44	–	44
Marine products	–	–	–	–	37	37	–	37	37
Miscellaneous	–	–	–	6	–	6	6	–	6
Estate crops	–	238	238	47	1	48	47	239	286
Construction Materials	224	–	224	104	172	276	328	172	500
Machinery	81	–	81	29	53	82	110	53	163
Vehicles	40	–	40	8	11	19	48	11	59
Fertilizer	–	–	–	45	–	45	45	–	45
Wood	–	138	138	–	941	941	–	1,079	1,079
Logs	–	–	–	–	551 (707)	551 (707)	–	551 (707)	551 (707)
Processed timber	–	136	136	–	389	389	–	525	525
Other wood products	–	2	2	–	1	1	–	3	3
Oil	354	3,805	4,159	6,545	3,318	9,863	6,899	7,123	14,022
Crude oil	–	3,770	3,770	6,545	–	6,545	6,545	3,770	10,315
Petroleum products	354	35	389	–	3,318	3,318	354	3,353	3,707
Miscellaneous	208	75	283	293	60	353	501	135	636
Total	907	4,256	5,163	7,151	4,593	11,744	8,058	8,849	16,907

Of these cargoes, general cargoes are estimated at 765 thousand tons in 1985 and 1,806 thousand tons in 2000. General cargoes referred to here are items listed in Table 6-35 and Table 6-36 except wood (logs, processed timber, other wood products) and oil (crude oil, petroleum products). Of these general cargoes, some of them are used by PERTAMINA and therefore, handled through the port facilities owned by PERTAMINA. Accordingly general cargoes handled at ADPEL are estimated as 611 thousand tons in 1985 and 1,460 thousand tons in 2000 as shown in Table 6-37.

Table 6-37 Projection of General Cargo Volume Handled at ADPEL in the Port of Balikpapan

Item	1976 (1,000tons)	1978 (1,000tons)	1985 (1,000tons)	2000 (1,000tons)	1985/1976	A.A.G.R.	2000/1976	A.A.G.R.
Foreign trade						%		%
Inport	21	18	222	416	10.57	30.0	19.81	13.2
Export	3	2	123	313	41.00	51.0	104.33	21.4
Sub-Total	24	20	345	729	14.38	34.5	30.38	15.3
Domestic trade								
Inbound	81	85	186	573	2.30	9.7	7.07	8.5
Outbound	29	25	80	158	2.76	12.0	5.45	7.3
Sub-Total	110	110	266	731	2.42	10.3	6.65	8.2
Total	134	130	611	1,460	4.56	18.4	10.90	10.5

Note: A.A.G.R. — Average Annual Growth Ratio

6-2-1 The Method of Estimation

(1) The method of estimating the volume of cargoes brought in or shipped out of East Kalimantan via the Port of Balikpapan.

1) Foodstuff

With regard to rice, it is assumed that self-sufficiency will be established in East Kalimantan in 2000, and in 1985 the difference between consumption and production in East Kalimantan will be imported via the Port of Balikpapan.

With regard to wheat and sugar, it is assumed that they will not be produced in East Kalimantan in 1985 and 2000 and the volume required in the service area of the Port of Balikpapan as domestic trade port, will be brought in from other areas of the country.

With regard to marine products, it is assumed that one half of the difference between production and consumption in East Kalimantan will be exported to other areas of the country in 1985 and 2000.

With regard to livestock products, it is assumed that the difference between consumption and production in East Kalimantan will be brought in from other areas of the country in 1985 and 2000.

With regard to maize, cassaba, sweet potato, peanut and soya beans, etc., it is assumed that self-sufficiency will be possible in East Kalimantan in 1985 and 2000 and, therefore, they are not included in the volume of cargo handled through the Port of Balikpapan.

2) Estate Crops

As mentioned in 6-1-4 "Projection of Estate Agriculture", the difference between production and consumption in East Kalimantan will be shipped out of East Kalimantan for overseas and domestic consumption in 1985 and 2000. From the Port of Balikpapan it is estimated that estate crops produced in Area 2 to Area 4 of the service areas mentioned in 5-1 will be exported.

3) Fertilizer

It is assumed that the production at Bontang Plant in 1985 will completely fill the provinces demand for nitrogen fertilizer in 1985 and 2000, and other fertilizers will be imported from domestic sources. The volume of fertilizers brought in through the Port of Balikpapan is assumed to be allocated according to the population ratio of the service area of the Port of Balikpapan.

4) Timber

Domestic and export shipments of logs and processed timber from East Kalimantan in 1985 and 2000 are given in 6-1-7 "Projection of Forestry", and 20% of this is estimated to be shipped from the Port of Balikpapan (in 1976, the ratio between log shipments from the Port of Balikpapan and log shipments from East Kalimantan is 0.2).

As mentioned in 6-1-7, it is assumed that no log exports from the Port of Balikpapan will be made in 2000.

5) Crude Oil and Petroleum Products

In 1985 and 2000, crude oil handled through the Port of Balikpapan is estimated to correspond to the growth of GRDP in the crude oil sector, and petroleum products are estimated to correspond to the growth of GRDP in the refined petroleum sector.

6) Construction Materials, Machinery, Vehicles and Miscellaneous

As it is difficult to estimate the cargo volume of these items from the balance of supply and demand in East Kalimantan, the cargo volume handled through public facilities is obtained in the following manner. Included in these items are many cargoes which were imported by foreign trade liners through the Port of Surabaya, and then shipped from there to other ports in East Kalimantan. When the Port of Balikpapan becomes a port of regular call for foreign trade liners, most of these cargoes will be brought into the Port of Balikpapan as direct imports. The following method of estimation takes this into consideration.

The following gives a description of the method of estimating these cargoes in 1985, and the same method is also applied for the estimation of the cargo in 2000.

Import into East Kalimantan in 1985, a_{1985}, are calculated by increasing the imports in 1978 in proportion to the growth of GRDP of the sector concerned.

ie: $a_{1985} = a_{1978} \times (GRDP_{1985}/GRDP_{1978})$

a_{1985} : Imports into East Kalimantan in 1985

a_{1978} : Imports into East Kalimantan in 1978

$GRDP_{1985}$: GRDP of the sector concerned in 1985
$GRDP_{1978}$: GRDP of the sector concerned in 1978

b_{1985}, or domestic inbound cargo volume into East Kalimantan in 1985, is calculated by increasing the inbound cargo volume in 1978 in proportion to the growth of GRDP.

ie: $b_{1985} = b_{1978} \times (GRDP_{1985}/DRDP_{1978})$

b_{1985} : inbound cargo volume into East Kalimantan in 1985
b_{1978} : inbound cargo volume into East Kalimantan in 1978

"X" represents a ratio of cargo imported through the Port of Surabaya and then transshipped to other ports in East Kalimantan to b_{1985}, in the case where the Port of Balikpapan is not organized as a port of regular call for foreign trade liners. In other words, "X" represents the percentage of cargo directly imported into the Port of Balikpapan in b_{1985}, in the case where the Port of Balikpapan is developed into a port of regular call for foreign trade liners.

When the Port of Balikpapan is developed into a port of regular call for foreign trade liners, the volume of these cargoes is calculated as follows.

Imports: $a_{1985} + b_{1985} \cdot x$

Exports: $c_{1978} \times (GRDP_{1985}/GRDP_{1978})$

Inbound: $b_{1985} \cdot (1 - x) \times P_4/P_E$

Outbound: $(a_{1985} + b_{1985} \cdot x) \times \dfrac{P_E - (P_3 + P_4)}{P_E}$

Where,
c_{1978} : Exports of East Kalimantan in 1978
P_E : Population of East Kalimantan in 1985
P_3 : Population of Area – 3 (service area of the Port of Samarinda as domestic trade port) in 1985
P_4 : Population of Area – 4 (service area of the Port of Balikpapan as domestic trade port) in 1985

With regard to "X", as the ratio of the foreign products to the inbound construction materials handled at the public facilities of Balikpapan and Samarinda in 1978 is 0.2, this figure is used.

Future cargo volume to be handled at PERTAMINA is obtained by increasing the cargo volume handled at PERTAMINA in 1978 in proportion to the growth of GRDP of crude oil sector.

(2) The method of estimating cargo volume brought into or shipped out of Central Sulawesi via the Port of Balikpapan

As mentioned in 5-1, when the Port of Balikpapan is developed into a port of regular call for foreign trade liners, part of the goods heretofore imported or exported via Ujun Pandang or Bitung will be imported or exported through the Port of Balikpapan.

As for export, estate crops are to be exported from Central Sulawesi. One third of the balance of estate crops between production and consumption in Central Sulawesi is to be transshipped from the Port of Donggala to the Port of Balikpapan, and then exported to other countries.

As for imports, there will be construction materials, machinery, vehicles and miscellaneous goods which will be imported into Central Sualwesi via the Port of Balikpapan. As for these goods, it is also assumed that one third of the imports in Central Sulawesi is through Balikpapan. Accordingly, the import volume in 1985 is estimated by the following formulae.

$$d_{1985} = (a_{1985} + b_{1985} \cdot x) \times (GRDP_{1985,CS}/GRDP_{1985,EK}) \times 1/3$$

Where, d_{1985} : Imports into Central Sulawesi via the Port of Balikpapan in 1985 (at the Port of Balikpapan accounted for as imports and outbound cargo, and at Donggala as inbound cargo)

$(a_{1985} + b_{1985} \cdot x)$: Imports in the Port of Balikpapan for East Kalimantan in 1985

$GRDP_{1985,EK}$: GRDP of the sector concerned in East Kalimantan in 1985

$GRDP_{1985,CS}$: GRDP of the sector concerned in Central Sulawesi in 1985

Imports in 2000 are estimated in the same way.

6-2-2 Estimation

(1) Estimation of cargo volume brought into or shipped from East Kalimantan via the Port of Balikpapan.

1) Foodstuff

a) Polished rice (shortage will be met with imports in 1985; selfsufficiency will be attained in 2000)

Production of wetland paddy and dryland paddy in 1985 (on unhulled basis) may be obtained from Table 6-18 as follows:

$129 + 115 = 244{,}000$ tons

On polished basis:

$244 \times 0.94 \times 0.52 = 119{,}000$ tons

Per capita annual supply will be:

$119 \times 10^6 / 1.57 \times 10^6 = 75.8$ kg

Since the per capita consumption of milled rice in 1976 will be Production 59.5 kg + Total imports 34.5 kg = 94.0 kg, if the per capita consumption in 1985 is to be 115.6 kg, total imports required will be:

$(115.6 - 75.8) \times 10^{-6} \times 1.57 \times 10^6 = 62{,}500$ tons

This 62,500 tons will all be brought to the Port of Balikpapan as imported cargo. It will then be transported by land to Area-3 and Area-4 and transshipped to Area-1 and Area-2 via Balikpapan. The volume of the transshipment is calculated using the population ratio as follows.

$$62{,}500 \times \frac{260 + 90}{1{,}570} = 13{,}900 \text{ ton}$$

b) Wheat flour (to be imported domestically in flour; no local production)

According to the National Food Balance Sheet for 1974 (Table 6-15), the daily per capita consumption of wheat flour was 13.42 g; it was 87.0 g in Japan in 1976. However, it is consumed in a large quantity as noodles in Japan. Accordingly, we may take the half-way between the consumption level in Indonesia for 1974 and that in Japan for 1976.

$(13.42 + 87.0) \times 1/2 = 50.2$ g.....(A)

The daily per capita consumption of wheat in Japan grew from 70.6 g in 1960 to 87.0 g in 1976, registering an increase of 5.4% per annum. Since the rate of growth in wheat consumption in Indonesia is not available, the Japanese rate may be used here to obtain the daily per capita consumption in 2000 as follows.

$13.42 \times 1.054^{26} = 13.42 \times 3.93 = 52.7$ g ... (B)

Thus, from (A) and (B), the rate of growth in per capita consumption may be obtained as 5.4%.

Then,

2000 $52.7 \times 10^{-6} \times 365 \times 3.53 \times 10^6 = 67.901$ tons ≒ 67,900 tons

1985 $13.42 \times 1.054^{11} = 13.42 \times 1.78 = 23.9$ g

$23.9 \times 10^{-6} \times 365 \times 1.57 \times 10^6 = 13{,}696$ ≒ 13,700 tons

It is assumed that flour is imported domestically in bag. Domestic imports to Balikpapan may be allocated on the basis of the population ratio of the hinterland. Thus,

2000 $67.9 \times 1.57/3.53 = 30{,}200$ tons

1985 $13.5 \times 0.62/1.57 = 5{,}500$ tons

c) Sugar (to be imported domestically in refined sugar; no local production).

According to National Food Balance Sheet for 1974 (Table 6-15), the daily per capita consumption of sugar was 21.79 g in refined sugar and 13.03 g in sugar cane. The growth rate of per capita consumption of refined sugar was 5%. This growth rate may be used to estimate the per capita consumption in 1985 and 2000 as follows.

2000 $21.79 \times 1.05^{26} = 21.79 \times 3.56 = 77.6$ g/day = 28.3 kg/year.

1985 $21.79 \times 1.05^{11} = 21.79 \times 1.71 = 37.3$ g/day = 13.6 kg/year.

The per capita consumption in major countries of the world is as follows (Source: Nihon Kokusei Zue).

Japan ..... 69 g/day

U.S.A. ..... 153 g/day (over 100 g/day in most advanced

nations of the West).

India ..... 49 g/day

Assuming that the above per capita consumption will be in force, domestic imports to Balikpapan may be obtained as follows (multiplied by the population of the service area of Balikpapan).

2000 $28.3 \times 10^{-3} \times 1.57 \times 10^{6} = 44{,}400$ t

1985 $13.6 \times 10^{-3} \times 0.62 \times 10^{6} = 8{,}400$ t

d) Fishery products (possible domestic exports to other areas either as frozen or chilled fish or as processed products).

According to the Table 6-29, surplus capacity for domestic exports is as follows.

2000 Surplus capacity for domestic exports: 73,000 tons

1985 Surplus capacity for domestic exports: 48,000 tons

However, in view of freezing and processing facilities, about half of the amount a bove is to be considered for domestic exports from Balikpapan.

2000 $73.0 \times 1/2 = 36{,}500$ t

1985 $48.0 \times 1/2 = 24{,}000$ t

e) Livestock products (insufficiency is expected to continue into 2000, which is to be met with domestic imports of frozen or processed products).

2000 5,700 tons

1985 700 tons

The above are to be regarded as processed livestock products.

2) Plantation crops (development is to be promoted for exports).

Table 6-28 is based on the assumption that a total area of 2,330 km^2 will be developed in 2000; this amounts to 20% of the total upland area for possible development for plantations. Since plantation crops are mainly export-oriented, development is expected to take place mainly the Mahakam River basin.

Accordingly, those produced in Area 2 to Area 4 are all expected to be sent by land to Balikpapan to be exported. However, cloves are to be exported to Jawa via Balikpapan.

2000	1)	Exports:	Dry cargo	39.6 x 3,090/3,530	= 34,700 tons
			Palm oil	178.9 x 3,090/3,530	= 156,600 tons
	2)	Domestic exports:		Dry cargo	1,300 tons
1985	1)	Exports:	Dry cargo	23.9 x 1,310/1,570	= 19,900 tons
			Palm oil	64.3 x 1,310/1,570	= 53,700 tons
	2)	Domestic exports:		Dry cargo	600 tons

3) Construction materials

In 1978, 40,900 tons of construction materials were imported through Balikpapan, of which 33,400 tons were for PERTAMINA and 7,500 tons were general construction materials (there were no imports of construction materials through Samarinda in that year).

The amount of construction materials domestically imported through Balikpapan and Samarinda in 1978 was 40,200 tons, of which 7,200 tons were for PERTAMINA at Balikpapan.

The amount of construction materials domestically exported from Balikpapan in 1978 was 41,600 tons, of which 40,100 tons were for PERTAMINA and 1,500 tons were general construction materials (there were no domestic exports from Samarinda in that year).

Therefore, the volume of cargo handled at the public berths is estimated as follows.

2000

$$a_{2000} = 7{,}500 \times (GRDP_{const,\,2000}/GRDP_{const,\,1978})$$

$$= 7{,}500 \times 44.5/6.6 = 50{,}600 \text{ tons}$$

$$b_{2000} = 33{,}000 \times (GRDP_{const,\,2000}/GRDP_{const,\,1978})$$

$$= 33{,}000 \times 44.5/6.6 = 222{,}500 \text{ tons}$$

where, $GRDP_{const,2000}$: GRDP of construction sector in East Kalimantan in 2000 (Million US$)

$GRDP_{const,1978}$: GRDP of construction sector in East Kalimantan in 1978 (Million US$)

Accordingly

Import:

$$50,600 + 222,500 \times 0.2 = 95,100 \text{ tons}$$

Domestic import:

$$222,500\ (1 - 0.2) \times \frac{1,570}{3,530} = 79,200 \text{ tons}$$

Domestic export:

$$(50,600 + 222,500 \times 0.2) \times \frac{3,530 - (1,250 + 1,570)}{3,530} = 19,100 \text{ tons}$$

1985

$a_{1985} = 7,500 \times (GRDP_{const,\ 1985}/GRDP_{const,\ 1978})$

$= 7,500 \times 12.1/6.6 = 13,800$ tons

$b_{1985} = 33,000 \times (GRDP_{const,\ 1985}/GRDP_{const,\ 1978})$

$= 33,000 \times 12.1/6.6 = 60,500$ tons

where, $GRDP_{const,1985}$: GRDP of construction sector in East Kalimantan in 1985 (Million US$)

Accordingly

Import:

$$13,800 + 60,500 \times 0.2 = 25,900 \text{ tons}$$

Domestic import:

$$60,500\ (1 - 0.2) \times 620/1,570 = 19,100 \text{ tons}$$

Domestic export:

$$(13,800 + 60,500 \times 0.2) \times \frac{1,570 - (600 + 620)}{1,570} = 5,800 \text{ tons}$$

Construction materials handled at PERTAMINA are estimated as follows:

2000

Import:

$$33,400 \times 48.0/13.7 = 117,000 \text{ tons}$$

Domestic import:

$$7,200 \times 48.0/13.7 = 25,200 \text{ tons}$$

Domestic export:

$$40,100 \times 48.0/13.7 = 140,500 \text{ tons}$$

1985

Import:

$$33,400 \times 21.4/13.7 = 52,100 \text{ tons}$$

Domestic import:

$$7,200 \times 21.4/13.7 = 11,200 \text{ tons}$$

Domestic export:

$$40,100 \times 21.4/13.7 = 62,600 \text{ tons}$$

4) Machinery

Imports of machinery in 1978 through Balikpapan and Samarinda totalled 23,900 tons, of which 5,600 tons for PERTAMINA were imported through Balikpapan.

In 1987, 27,700 tons of machinery were domestically imported through Balikpapan and Samarinda, of which 2,200 tons for PERTAMINA were domestically imported through Balikpapan.

In 1978, domestic exports of machinery from Balikpapan and Samarinda totalled 16,300 tons, of which 9,900 tons were shipped from Balikpapan for PERTAMINA.

Therefore, the volume of cargo handled through the public berths is estimated as follows.

2000

$a_{2000} = 18,300 \times (GRDP_{m,\ 2000}/GRDP_{m,\ 1978})$

$= 18,300 \times 935.5/404.1 = 42,400$ tons

$b_{2000} = 25,500 \times (GRDP_{m,\ 2000}/GRDP_{m,\ 1978})$

$= 25,500 \times 935.5/404.1 = 59,000$ tons

where, $GRDP_{m,\ 2000}$: GRDP of sectors other than mining and miscellaneous sectors in East Kalimantan in 2000 (Million US$)

$GRDP_{m,1978}$: GRDP of sectors other than mining and miscellaneous sectors in East Kalimantan in 1978 (Million US$)

Accordingly

Import:

$42,400 + 59,000 \times 0.2 = 54,200$ tons

Domestic import:

$59,000 \times (1 - 0.2) \times \frac{1,570}{3,530} = 21,000$ tons

Domestic export:

$(42,400 + 59,000 \times 0.2) \times \frac{3,530 - (1,250 + 1,570)}{3,530} = 10,900$ tons

1985

$a_{1985} = 18,300 \times (GRDP_{m,1985}/GRDP_{m,1978})$

$= 18,300 \times 651.0/404.1 = 29,400$ tons

$b_{1985} = 25,000 \times (GRDP_{m,1985}/GRDP_{m,1978})$

$= 25,500 \times 651.0/404.1 = 41,100$ tons

where, $GRDP_{m,1985}$: GRDP of sectors other than mining and miscellaneous sectors in East Kalimantan in 1985 (Million US$)

Accordingly

Import:

$29,400 + 41,100 \times 0.2 = 37,600$ tons

Domestic import:

$41,100 (1 - 0.2) \times \frac{620}{1,570} = 13,000$ tons

Domestic export:

$(29,400 + 41,100 \times 0.2) \times \frac{1,570 - (600 + 620)}{1,570} = 8,400$ tons

Also, machinery handled at PERTAMINA is estimated as follows.

2000

Import:

$5,600 \times 48.0/13.7 = 19,600$ tons

Domestic import:

$2,200 \times 48.0/13.7 = 7,700$ tons

Domestic export:

$9,900 \times 48.0/13.7 = 34,700$ tons

1985

Import:

$5,600 \times 21.4/13.7 = 8,700$ tons

Domestic import:

$2,200 \times 21.4/13.7 = 3,500$ tons

Domestic export:

$9,900 \times 21.4/13.7 = 15,500$ tons

5) Vehicles

In 1978, imports of vehicles through Balikpapan and Samarinda totalled 4,600 tons. Domestic imports of vehicles through Balikpapan and Samarinda totalled 3,200 tons in 1978.

Therefore, the volume of cargo handled through the public berths is estimated as follows.

2000

$a_{2000} = 4,600 \times (GRDP_{V,2000}/GRDP_{V,1978})$

$= 4,600 \times 998.8/146.7 = 31,300$ tons

$b_{2000} = 3,200 \times (GRDP_{V,2000}/GRDP_{V,1978})$

$= 3,200 \times 998.8/146.7 = 21,800$ tons

where, $GRDP_{V,2000}$: GRDP of sectors other than mining and forestry in East Kalimantan in 2000 (Million US$)

$GRDP_{V,1978}$: GRDP of sectors other than mining and forestry in East Kalimantan in 1978 (Million US$)

Accordingly

Import:

$31,300 + 21,800 \times 0.2 = 35,700$ tons

Domestic import:

$$21,800\,(1 - 0.2) \times \frac{1,570}{3,530} = 7,800 \text{ tons}$$

Domestic export:

$$(31,300 + 21,800 \times 0.2) \times \frac{3,530 - (1,250 + 1,570)}{3,30} = 7,200 \text{ tons}$$

1985

$a_{1985} = 4,600 \times (GRDP_{V,1985}/GRDP_{V,1978})$

$= 4,600 \times 400.1/146.7 = 12,500$ tons

$b_{1985} = 3,200 \times (GRDP_{V,1985}/GRDP_{V,1978})$

$= 3,200 \times 400.1/146.7 = 8,700$ tons

where, $GRDP_{V,1985}$: GRDP of sectors other than mining and forestry in East Kalimantan in 1985 (Million US$)

Accordingly

Import:

$12,500 + 8,700 \times 0.2 = 14,200$ tons

Domestic import:

$8,700\,(1 - 0.2) \times 620/1,570 = 2,700$ tons

Domestic expt:

$$(12,500 + 8,700 \times 0.2) \times \frac{1,570 - (600 + 620)}{1,570} = 3,200 \text{ tons}$$

6) Fertilizer (nitrogen fertilizer is self-sufficient as it is produced at Bontang Plant; others are to be domestic imports).

Required amount of fertilizer is to be computed for both farm agriculture and estate agriculture as follows

2000

a) Farm agriculture

Wetland Paddy	300 kg/ha = 30 t/km^2
	30 x 1,110 = 33,300 t
Dryland Paddy	150 kg/ha = 15 t/km^2
	15 x 2,180 = 32,700 t
Cassava	300 kg/ha = 35 t/km^2
	30 x 230 = 6,900 t
Maize	350 kg/ha = 35 t/km^2
	40 x 740 = 25,900 t
Sweet potatoes	250 kg/ha = 25 t/km^2
	25 x 70 = 1,750 t
Soybeans	150 kg/ha = 15 t/km^2
	15 x 190 = 2,850 t
Peanuts	400 kg/ha = 40 t/km^2
	x 80 = 3,200 t
	Sub-total 106,600 t

b) Estate agriculture

It is to be assumed that rubber and palm oil will require 530 kg/ha; others 250 kg/ha. (Table 6-19)

53 x 1,100 = 58,300 t

25 x 1,230 = 30,750 t

Sub-total 89,050 t

Total: 106,600 + 89,050 = 195,700 t

1985

a) Farm Agriculture

Wetland Paddy	30 t/km² x 0.9 x 357	= 9,640 t
Dryland Paddy	15 t/km² x 0.9 x 676	= 9,130 t
Cassava	30 t/km² x 0.9 x 85.1	= 2,300 t
Maize	35 t/km² x 0.9 x 82.1	= 2,590 t
Sweet Potatoes	25 t/km² x 0.9 x 21.6	= 490 t
Soybeans	15 t/km² x 0.9 x 34.2	= 460 t
Peanuts	40 t/km² x 0.9 x 18.5	= 670 t
	Sub-total	25,380 t

Note: It is assumed from Table 6-18 that the required amount of fertilizer in 1985 will be 90% of the 2000 level.

b) Estate agriculture

It is assumed that rubber and palm oil will require 530 kg/ha x 0.9; others 250 kg/ha x 0.9. (Table 6-19)

53 x 0.9 x 480 = 22,900 t

25 x 0.9 x 600 = 13,500 t

Sub-total 36,400

Volume ratio of nitrogen, phosphate and potassium fertilizer was 28.7: 16.0: 14.2 (total 58.9 kg/ha) according to the world average in 1975 (Source: Nihon Kokusei Zue). This ratio may be used with the amount of fertilizer consumption obtained above to divide into nitrogen fertilizer and others. It is to be assumed that nitrogen fertilizer is to be self-sufficient from Bontang Plant (to be distributed by land transportation) and others are to be imported domestically.

2000 Other fertilizers = 195,700 x 30.2/58.9 = 100,340 t

Domestic imports to Balikpapan are to be allocated according to the population ratio of the hinterland (Table 5-2).

100,340 x 1,570/3,530 = 44,600 t

1985 Other fertilizers = 61,680 x 30.2/58.9 = 31,630 t

Domestic imports to Balikpapan are to be allocated according to the population of the hinterland.

31,630 x 620/1,570 = 12,500 t

7) Timber

As for timber, an estimate is to be made based on the prospects of forestry described in the clause of 6-1-7.

2000

Exports of logs from Balikpapan are to be nil.

With regard to domestic exports of logs, exports of processed wood and domestic exports of processed wood, Balikpapan is to handle 20% of the total amount of East Kalimantan in each category. (From 1972 to 1976, exports of logs from Balikpapan accounted for roughly 20% of the total log exports from East Kalimantan.)

Domestic exports of logs:	3,535 x 0.2 = 707,000 m³ = 551,000 t
Exports of processed timber:	1,362 x 0.2 = 272,000 m³ = 136,000 t
Domestic exports of processed timber:	3,890 x 0.2 = 778,000 m³ = 389,000 t

1985

Balikpapan is to handle 20% of exports and domestic exports of logs and of exports and domestic exports and domestic exports of processed timber from East Kalimantan.

Exports of logs:	5,298 x 0.2 = 1,060,000 m³ = 826,000 t
Domestic exports of logs:	1,414 x 0.2 = 283,000 m³ = 221,000 t
Exports of processed timber:	2,708 x 0.2 = 542,000 m³ = 271,000 t
Domestic exports of processed timber:	1,556 x 0.2 = 311,000 m³ = 156,000 t

8) Crude oil and petroleum products

With regard to cargo volume in 2000 and 1985, crude oil is increased in proportion to the growth of GRDP of the crude oil sector and petroleum products in proportion to the growth of GRDP of the oil refining sector.

a) Crude oil

2000

Export: 1,077,000 x 48.0/13.7 = 3,770,000 tons

Domestic Import: 1,870,000 x 48.0/13.7 = 6,545,000 tons

1985

Export: 1,077,000 x 21.4/13.7 = 1,680,000 tons

Domestic Import: 1,870,000 x 21.4/13.7 = 2,917,000 tons

b) Petroleum products

2000

Import: The import volume in 2000 is to be equal to the import volume in 1978.

Export: 20,000 x 221.7/126.4 = 35,000 tons

Domestic Export: 1,891,000 x 221.7/126.4 = 3,318,000 tons

1985

Import: The import volume in 1985 is to be equal to the import volume in 1978.

Export: 20,000 x 221.7/126.4 = 35,000 tons

Domestic Export: 1,891,000 x 221.7/126.4 = 3,318,000 tons

9) Other general cargo

In 1978, imports of other general cargo through Balikpapan and Samarinda totalled 3,000 tons.

Domestic imports of other general cargo through Balikpapan and Samarinda totalled 121,000 tons in 1978.

And exports of other general cargo through Balikpapan and Samarinda totalled 11,000 tons in 1978.

Therefore, the volume of cargo handled through the public berth is estimated as follows.

2000

$a_{2000} = 3,000 \times (GRDP_{o,\,2000}/GRDP_{o,\,1978})$

$= 3,000 \times 998.8/146.7 = 20,400$ tons

$b_{2000} = 121,000 \times (GRDP_{o,\,2000}/GRDP_{o,\,1978})$

$= 121,000 \times 998.8/146.7 = 823,800$ tons

where, $GRDP_{o,\,2000}$: GRDP of sectors other than mining and forestry in East Kalimantan in 2000 (Million US$)

$GRDP_{o,\,1978}$: GRDP of sectors other than mining and forestry in East Kalimantan in 1978 (Million US$)

Accordingly

Import : $20,400 + 823,000 \times 0.2 = 185,200$ tons

Domestic Import : $823,800\,(1 - 0.2) \times 1,570/3,530 = 293,100$ tons

Export : $11,000 \times 998.8/146.7 = 74,900$ tons

Domestic Export : $(20,400 + 823,000 \times \dfrac{3,530 - (1,250 + 1,570)}{3,530} = 37,200$ tons

1985

$a_{1985} = 3,000 \times (GRDP_{o,\,1985}/GRDP_{o,\,1978})$

$= 3,000 \times 400.1/146.7 = 8,200$ tons

$b_{1985} = 121,000 \times (GRDP_{o,\,1985}/GRDP_{o,\,1908})$

$= 121,000 \times 400.1/146.7 = 330,000$ tons

where, $GRDP_{o,\,1985}$: GRDP of sectors other than mining and forestry in East Kalimantan in 1985 (Million US$)

Accordingly

Import : $8,200 + 330,000 \times 0.2 = 74,200$ tons

Domestic Import : $330,000\,(1 - 0.2) \times 620/1,570 = 104,300$ tons

Export : $11,000 \times 400.1/146.7 = 30,000$ tons

Domestic export : $(8,200 + 330,000 \times 0.2) \times \dfrac{1,570 - (600 + 620)}{1,570}$

$= 16,500$ tons

(2) Estimation of the cargo volume brought in or shipped out from Central Sulawesi via the Port of Balikpapan

1) Estate Crops

According to "Statistical Yearbook of Indonesia, 1976", the only estate crops harvested in Central Sulawesi in 1973 were coconuts.

Also in the "Feasibility Study Report on the Expansion Project of the Bitung Port, March 1978, JICA" it is stated that the most important estate crops in North Sulawesi, Central Sulawesi and Maluku are coconuts, other estate crops are very few, and this will not change in the future. Therefore, only coconuts are taken up here as estate crops. The volume of export and domestic shipments of coconuts from Central Sulawesi in 1985 and in 2000 is calculated using the figures in the report of the Port of Bitung as shown in Table 6-38.

Table 6-38 Exports and Domestic Exports of Coconut from Central Sulawesi in 1985 and in 2000

Year	(1) Coconut Field (1,000 ha)	(2) Yield Rate (t/ha)	(3) = (1) x (2) Production of Coconut (t)	(4) Population (1,000 person)	(5) Per capita Annual Consumption (t/person)	(6) = (4) x (5) Consumption in Central Sulawesi (t)	(7) = (4) – (6) Exports and Domestic Exports (t)
1985	102	0.7	71,400	1,340	0.01	13,400	58,000
2000	102	1.7	173,400	2,080	0.015	31,200	142,200

The volume of coconuts brought into the Port of Balikpapan and then exported to other countries is estimated as one third of export and domestic shipment of coconut from Central Sulawesi, and calculated as follows.

2000

142,200 x 1/3 = 47,000 tons

1985

58,000 x 1/3 = 19,000 tons

2) Construction materials (Import and domestic export in the Port of Balikpapan)

2000

95,100 x 688.0/1,856.8 x 1/3 = 11,700 tons

1985

25,900 x 160.0/1,856.8 x 1/3 = 1,200 tons

3) Machinery (Import and domestic export in the Port of Balikpapan)

2000

54,200 x 688.0/1,856.8 x 1/3 = 6,700 tons

1985

37,600 x 160.0/1,181.1 x 1/3 = 1,700 tons

4) Vehicles (Import and domestic export in the Port of Balikpapan)

2000

35,700 x 688.0/1,856.8 x 1/3 = 4,400 tons

1985

14,200 x 160.0/1,181.1 x 1/3 = 600 tons

5) Miscellaneous (Import and domestic export in the Port of Balikpapan)

2000

185,200 x 688.0/1,856.8 x 1/3 = 22,900 tons

1985

74,200 x 160.0/1,181.1 x 1/3 = 3,400 tons

6-2-3 Estimate of cargo handled by commodity and facilities

Estimate of cargo volume by commodity and by facilities has been made in the following manner.

All oil and petroleum products are to be handled by PERTAMINA facilities.

Logs are to be handled on the water; processed timber is to be shipped from private facilities.

Foodstuffs, estate crops, vehicles, fertilizer and miscellaneous cargo are to be handled by the public berth of ADPEL.

As for construction materials and machinery, those for PERTAMINA are to be handled by PERTAMINA's own facilities and general construction materials and machinery by the public berth of ADPEL.

Based on the above approach, estimate of cargo volume handled by commodity and by facilities may be arranged as Tables 6-39 and 6-40.

Table 6-41 and 6-42 shows general cargo volume handled by ADPEL, by commodity, in 2000 and in 1985.

Table 6-39 Projection of cargo volume handled in Balikpapan port by commodity, by facility (2000)

Unit: 1000 tons (1000 m³)

Commodity Group	Foreign Trade									Domestic Trade									Total								
	Discharged			Loaded			Total			Discharged			Loaded			Total			Discharged			Loaded			Total		
	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*
Food stuffs	–	–	–	–	–	–	–	–	–	80	–	–	37	–	–	117	–	–	80	–	–	37	–	–	117	–	–
Rice	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Wheat flour	–	–	–	–	–	–	–	–	–	30	–	–	–	–	–	30	–	–	30	–	–	–	–	–	30	–	–
Sugar	–	–	–	–	–	–	–	–	–	44	–	–	–	–	–	44	–	–	44	–	–	–	–	–	44	–	–
Marine products	–	–	–	–	–	–	–	–	–	–	–	–	37	–	–	37	–	–	–	–	–	37	–	–	37	–	–
Miscellaneous	–	–	–	–	–	–	–	–	–	6	–	–	–	–	–	6	–	–	6	–	–	–	–	–	6	–	–
Estate crops	–	–	–	238	–	–	238	–	–	47	–	–	1	–	–	48	–	–	47	–	–	239	–	–	286	–	–
Construction materials	107	117	–	–	–	–	107	117	–	79	25	–	31	141	–	110	166	–	186	142	–	31	141	–	217	283	–
Machinery	61	20	–	–	–	–	61	20	–	21	8	–	18	35	–	39	43	–	82	28	–	18	35	–	100	63	–
Vehicles	40	–	–	–	–	–	40	–	–	8	–	–	11	–	–	19	–	–	48	–	–	11	–	–	59	–	–
Fertilizer	–	–	–	–	–	–	–	–	–	45	–	–	–	–	–	45	–	–	45	–	–	–	–	–	45	–	–
Wood	–	–	–	–	–	138	–	–	138	–	–	–	–	–	941	–	–	941	–	–	–	–	–	1,079	–	–	1,079
Logs	–	–	–	–	–	–	–	–	–	–	–	–	–	–	551 (707)	–	–	551 (707)	–	–	–	–	–	551 (707)	–	–	551 (707)
Processed timber	–	–	–	–	–	136	–	–	136	–	–	–	–	–	389	–	–	389	–	–	–	–	–	525	–	–	525
Other wood products	–	–	–	–	–	2	–	–	2	–	–	–	–	–	1	–	–	1	–	–	–	–	–	3	–	–	3
Oil	–	354	–	–	3,805	–	–	4,159	–	–	6,545	–	–	3,318	–	–	9,863	–	–	6,899	–	–	7,123	–	–	14,022	–
Crude oil	–	–	–	–	3,770	–	–	3,770	–	–	6,545	–	–	–	–	–	6,545	–	–	6,545	–	–	3,770	–	–	10,315	–
Petroleum products	–	354	–	–	35	–	–	389	–	–	–	–	–	3,318	–	–	3,318	–	–	354	–	–	3,335	–	–	3,707	–
Miscellaneous	208	–	–	75	–	–	283	–	–	293	–	–	60	–	–	353	–	–	501	–	–	135	–	–	636	–	–
Total	416	491	–	313	3,805	138	729	4,296	138	573	6,578	–	158	3,494	941	731	10,072	941	989	7,069	–	471	7,299	1,079	1,460	14,368	1,079

*Including special facilities for handling processed timber

Table 6-40 Projection of cargo volume handled in Balikpapan port by commodity, by facility (1985)

Unit: 1000 tons (1000 m³)

Commodity Group	Foreign Trade									Domestic Trade									Total								
	Discharged			Loaded			Total			Discharged			Loaded			Total			Discharged			Loaded			Total		
	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*	ADPEL	PER-TAMINA	Basin*
Food stuffs	63	–	–	–	–	–	63	–	–	15	–	–	38	–	–	53	–	–	78	–	–	38	–	–	116	–	–
Rice	63	–	–	–	–	–	63	–	–	–	–	–	14	–	–	14	–	–	63	–	–	14	–	–	77	–	–
Wheat floor	–	–	–	–	–	–	–	–	–	6	–	–	–	–	–	6	–	–	6	–	–	–	–	–	6	–	–
Sugar	–	–	–	–	–	–	–	–	–	8	–	–	–	–	–	8	–	–	8	–	–	–	–	–	8	–	–
Marine products	–	–	–	–	–	–	–	–	–	–	–	–	24	–	–	24	–	–	–	–	–	24	–	–	24	–	–
Miscellaneous	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	–	–	1	–	–	–	–	–	1	–	–
Estate crops	–	–	–	93	–	–	93	–	–	19	–	–	1	–	–	20	–	–	19	–	–	94	–	–	113	–	–
Construction materials	27	52	–	–	–	–	27	52	–	19	11	–	7	62	–	26	73	–	46	63	–	7	62	–	53	125	–
Machinery	40	9	–	–	–	–	40	9	–	13	4	–	10	16	–	23	20	–	53	13	–	10	16	–	63	29	–
Vehicles	15	–	–	–	–	–	15	–	–	13	–	–	4	–	–	7	–	–	18	–	–	4	–	–	22	–	–
Fertilizer	–	–	–	–	–	–	–	–	–	13	–	–	–	–	–	13	–	–	13	–	–	–	–	–	13	–	–
Wood	–	–	–	–	–	1,099	–	–	1,099	–	–	–	–	–	378	–	–	378	–	–	–	–	–	1,477	–	–	1,477
Logs	–	–	–	–	–	826 (1,060)	–	–	826 (1,060)	–	–	–	–	–	221 (283)	–	–	221 (283)	–	–	–	–	–	1,047 (1,343)	–	–	1,047 (1,343)
Processed timber	–	–	–	–	–	271	–	–	271	–	–	–	–	–	156	–	–	156	–	–	–	–	–	427	–	–	427
Other wood products	–	–	–	–	–	2	–	–	2	–	–	–	–	–	1	–	–	1	–	–	–	–	–	3	–	–	3
Oil	–	354	–	–	1,715	–	–	2,069	–	–	2,917	–	–	3,318	–	–	6,235	–	–	3,271	–	–	5,033	–	–	8,304	–
Crude oil	–	–	–	–	1,680	–	–	1,680	–	–	2,917	–	–	–	–	–	2,917	–	–	2,917	–	–	1,680	–	–	4,597	–
Petroleum products	–	354	–	–	35	–	–	389	–	–	–	–	–	3,318	–	–	3,318	–	–	354	–	–	3,353	–	–	3,707	–
Miscellaneous	77	–	–	30	–	–	107	–	–	104	–	–	20	–	–	124	–	–	181	–	–	50	–	–	231	–	–
Total	222	415	–	123	1,715	1,099	345	2,130	1,099	186	2,932	–	80	3,396	378	265	6,328	378	408	3,347	–	203	5,111	1,477	611	8,458	1,477

*Including special facilities for handling processed timber

Table 6-41 Projection of general cargo volume handled by ADPEL in the Port of Balikpapan, by commodity (2000)

(Unit: 1,000t)

Commodity Group	Foreign Trade			Domestic Trade			Total		
	Dis-charging	Load-ing	Total	Dis-charging	Load-ing	Total	Dis-charging	Load-ing	Total
Food stuffs	–	–	–	80	37	117	80	37	117
Rice	–	–	–	–	–	–	–	–	–
Wheat flour	–	–	–	30	–	30	30	–	30
Sugar	–	–	–	44	–	44	44	–	44
Marine products	–	–	–	–	37	37	–	37	37
Miscellaneous	–	–	–	6	–	6	6	–	6
Estate crops	–	238	238	47	1	48	47	239	286
Construction materials	107	–	107	79	31	110	186	31	217
Machinery	61	–	61	21	18	39	82	18	100
Vehicles	40	–	40	8	11	19	48	11	59
Fertilizer	–	–	–	45	–	45	45	–	45
Miscellaneous	208	75	283	293	60	353	501	135	636
Total	416	313	729	573	158	731	989	471	1,460

Table 6-42 Projection of general cargo volume handled by ADPEL in the Port of Balikpapan, by commodity (1985)

(Unit: 1,000t)

Commodity Group	Foreign Trade			Domestic Trade			Total		
	Dis-charging	Load-ing	Total	Dis-charging	Load-ing	Total	Dis-charging	Load-ing	Total
Food stuffs	63	–	63	15	38	53	78	38	116
Rice	63	–	63	–	14	14	63	14	77
Wheat flour	–	–	–	6	–	6	6	–	6
Sugar	–	–	–	8	–	8	8	–	8
Marine products	–	–	–	–	24	24	–	24	24
Miscellaneous	–	–	–	1	–	1	1	–	1
Estate crops	–	93	93	19	1	20	19	94	113
Construction materials	27	–	27	19	7	26	46	7	53
Machinery	40	–	40	13	10	23	53	10	63
Vehicles	15	–	15	3	4	7	18	4	22
Fertilizer	–	–	–	13	–	13	13	–	13
Miscellaneous	77	30	107	104	20	124	181	50	231
Total	222	123	345	186	80	266	408	203	611

6-3 Projection of Calling Vessels

Types of vessels calling at the Port of Balikpapan are ocean-going vessels such as log carriers, tankers, general cargo vessels, RLS vessels (Singapore route) and domestic liners such as special vessels for industry (log carriers, tankers and general cargo vessels), Interinsular RLS vessels, local vessels, sailing vessels and barges, as mentioned in 4-3-3.

These types of vessels are expected to call at the Port of Balikpapan in 1985 and in 2000, as today.

New types of vessels such as container vessels are also considered to call at the Port of Balikpapan on a long term basis, but they are not needed to be included in the program up to 2000.

When the new types of vessels are introduced into Indonesia, the Port of Balikpapan will not be the first port for their calls. It will take many years before they call at the Port of Balikpapan.

Based on the foregoing assumptions, average vessel size, by type of vessel, and the number of calling vessels by type of vessel in 1985 and 2000 are given in Table 6-43 and 6-44.

Vessels related to the public berth program include ocean-going vessels such as general cargo vessels and RLS (Singapore route) and domestic vessels such as Interinsular RLS, local vessels and sailing vessels. The largest size of vessels is considered as follows. In 1985, general ocean-going vessels are 10,000 DWT, RLS (Singapore route) 3,000 DWT, Interinsular RLS. 2,000 DWT and local vessels 300 DWT and sailing vessels the same as today and in 2000, general oceangoing vessels are 15,000 DWT, RLS (Singapore route) 5,000 DWT, Interinsular RLS 3,000 DWT, local vessels 500 DWT and sailing vessels the same as today.

The number of vessels berthing at the public berths is estimated as shown in Table 6-45.

Table 6-43 Projection of Average Size of Vessels by Type of Vessel Calling at the Port of Balikpapan

(Unit: D.W.T./Vessel)

Type of Vessel	1978	1985	2000
Ocean going vessels			
Log	6,992	7,000	10,000
Tanker	43,469	45,000	65,000
General	5,145	5,500	8,000
RLS (Singapore route)	1,909	2,000	3,000
Domestic trade vessels			
Special vessels for industry			
Log	3,362	3,500	5,500
Tanker	7,035	7,000	10,000
General	3,559	3,500	5,500
Interinsular RLS	557	600	1,500
Local vessels	195	200	300
Sailing vessels	180	200	200

Table 6-44 Projection of Number of Vessels by Type of Vessel Calling at the Port of Balikpapan

Type of Vessel	1978	1985	2000	Increase	
				1985/1978	2000/1978
Ocean going vessels					
Log	328	250	20	0.76	0.06
Tanker	60	80	120	1.33	2.00
General	25	410	570	16.40	22.80
RLS (Singapore route)	79	90	130	1.14	1.65
Domestic trade vessels					
Special vessels for industry					
Log	6	190	310	31.7	51.67
Tanker	632	1,040	1,100	1.65	1.74
General	57	60	100	1.05	1.75
Interinsular RLS	231	620	1,020	2.68	4.42
Local vessels	39	80	140	2.05	3.59
Sailing vessels	1,133	2,130	5,870	1.88	5.18
Total	2,590	4,950	9,380	1.91	3.62

Table 6-45 Projection of Number of Vessels by Type of Vessel Calling at the Port of Balikpapan (Public Berths)

Type of Vessel	1978	1985	2000	Increase	
				1985/1978	2000/1978
Ocean going vessels					
General	–	300	440	–	–
RLS (Singapore route)	22	90	130	4.09	5.91
Domestic trade vessels					
Interinsular RLS	231	620	1,020	2.68	4.42
Local vessels	39	80	140	2.05	3.59
Sailing vessels	1,133	2,130	5,870	1.88	5.18
Total	1,425	3,220	7,600	2.26	5.33

6-3-1 Estimation of the Volume of Cargo Handled by Type of Vessels

The volume of cargo by type of vessel must be estimated for projecting the number of calling vessels.

Regarding cargo carried by ocean-going vessels, log is carried by special log carriers and oil is carried by tankers. Other general cargoes are carried by general ocean-going vessels or RLS (Singapore route). Petroleum products listed in the export column of Table 6-39 and 6-40 are wax, and these are carried by general ocean-going vessels or RLS (Singapore route).

The ratio of cargoes carried by general ocean-going vessels and those carried by RLS (Singapore route) is estimated at 9 : 1 for import and 7 : 3 for export, in consideration of the ratio of import and export cargo for Singapore at the Port of Surabaya in 1977 and 1978, against the total import and export cargo at the same port.

As for cargoes carried by domestic vessels, log is carried by special log carriers, and oil and petroleum products are carried by tankers. General cargoes for PERTAMINA are carried by general cargo vessels belonging to special vessels for industry. Other general cargoes are carried by Interinsular RLS, local vessels and sailing vessels, with a ratio estimated at 7 : 0.6 : 2.4, in consideration of the present condition of the Ports of Surabaya and Balikpapan.

Table 6-46 shows the estimated values of cargoes handled by each type of vessels obtained through the foregoing method. Table 6-47 shows the volume of cargo handled through the public berths.

Table 6-46 Projection of the Volume of Cargo by Type of Vessel Handled at the Port of Balikpapan

(Unit: 1,000 tons)

Type of Vessel	1978			1985			2000		
	Discharging	Loading	Total	Discharging	Loading	Total	Discharging	Loading	Total
Ocean going vessels									
Log	–	1,430	1,430	–	1,099	1,099	–	138	138
Tanker	354	1,077	1,431	354	1,680	2,034	354	3,770	4,124
General	23	–	23	255	111	366	498	244	742
RLS (Singapore route)	40	23	63	28	47	75	55	104	159
Domestic trade vessels									
Special vessels for industry									
Log	–	12	12	–	378	378	–	941	941
Tanker	1,870	1,891	3,761	2,917	3,318	6,235	6,545	3,318	9,863
General	23	64	87	15	78	93	33	176	209
Interinsular RLS	57	11	68	130	56	186	401	111	512
Local vessels	6	2	8	11	5	16	34	9	43
Sailing vessels	22	12	34	45	19	64	138	38	176
Total	2,395	4,522	6,917	3,755	6,791	10,546	8,058	8,849	16,907

Table 6-47 Projection of the Volume of Cargo by Type of Vessel Handled at the Port of Balikpapan (Public Berth)

(Unit: 1,000 tons)

Type of Vessel	1978			1985			2000		
	Dis-charging	Load-ing	Total	Dis-charging	Load-ing	Total	Dis-charging	Load-ing	Total
Ocean going vessels									
General	–	–	–	194	76	270	361	209	570
RLS (Singapore route)	18	2	20	28	47	75	55	104	159
Domestic trade vessels									
Interinsular RLS	57	11	68	130	56	186	401	111	512
Local vessels	6	2	8	11	5	16	34	9	43
Sailing vessels	22	12	34	45	19	64	138	38	176
Total	103	27	130	408	203	611	989	471	1,460

6-3-2 Estimation of the Volume of Cargo Loaded and Unloaded per Vessel by Type of Vessel

In recent years, there has been no remarkable increase or decrease in the volume of cargo loaded or unloaded per vessel for any type of vessel. Therefore, the volume of cargo loaded or unloaded per vessel by type of vessel in 1985 is estimated to be about same as in 1978.

By 2000, the productivity of marine transportation is expected to increase and the volume of cargo loaded or unloaded per vessel except sailing vessels in 2000 is estimated to be about 1.5 times that in 1985. With regard to sailing vessels, as there is a limit to the volume of cargo per vessel, the volume of cargo loaded or unloaded in 2000 is estimated to be the same as in 1978.

This is shown in Table 6-48.

Table 6-48 Projection of the Volume of Cargo Loaded and Unloaded at the Port of Balikpapan by Type of Vessel

(Unit: tons/call)

Type of Vessel	1978	1985	2000
Ocean going vessels			
Log	4,360	4,400	7,000
Tanker	24,010	24,000	35,000
General	923	900	1,300
RLS (Singapore route)	794	800	1,200
Domestic tarde vessels			
Special vessels for industry			
Log	1,950	2,000	3,000
Tanker	5,947	6,000	9,000
General	1,527	1,500	2,200
Interinsular RLS	295	300	500
Local vessels	206	200	300
Sailing vessels	30	30	30

6-3-3 Estimation of the Number of Calling Vessels by Type of Vessel

$$\text{Number of Calling Vessels by Type of Vessel} = \frac{\text{Volume of Cargo Handled by Type of Vessel}}{\text{Volume of Cargo Loaded and Unloaded per Vessel by Type of Vessel}}$$

For the volume of cargo by type of vessel, Table 6-46 or 6-47 is used, and for the volume of cargo loaded and unloaded per vessel by type of vessel, Table 6-48 is used.
Table 6-44 and Table 6-45 are prepared by the above-given method.

6-3-4 Projection of Size of Vessels

(1) Average Size of Vessels

Average size of vessels is considered to increase or decrease according to the volume of cargo loaded and unloaded per vessel. Therefore, the average size of vessels in 1985 is estimated to be the same as in 1978, and that in 2000 is estimated to be 1.5 times that in 1985.

(2) Largest Size of Vessels

Only large size vessels using public berths are studied. In 1985, it is estimated that general ocean-going vessels are 10,000 DWT, RLS (Singapore route) 3,000 DWT, Interinsular 2,000 DWT, local vessels 300 DWT, and sailing vessels the same as today.
In 2000, it is estimated that general ocean-going vessels are 15,000 DWT, RLS (Singapore route) 5,000 DWT, Interinsular 3,000 DWT, local vessels 500 DWT, and sailing vessels the same as today.

6-3-5 Estimation of DWT by Type of Vessel

DWT of calling vessels by type of vessel is estimated by multiplying average size (DWT) of vessel with the number of vessels for each type of vessel. Table 6-49 shows the estimation. Table 6-50 shows the estimation of DWT of vessels berthing at public berths.

Table 6-49 Estimation of DWT by Type of Vessel at the Port of Balikpapan

(Unit: 1,000 DWT)

Type of Vessel	1978	1985	2000	Increase	
				1985/1978	2000/1978
Ocean going vessels					
Log	2,293	1,750	200	0.76	0.09
Tanker	2,608	3,600	7,800	1.38	2.99
General	129	2,255	4,560	17.48	35.35
RLS (Singapore route)	151	180	390	1.19	2.58
Domestic trade vessels					
Special vessels for industry					
Log	20	665	1,705	33.25	85.25
Tanker	4,446	7,280	11,000	1.64	2.47
General	203	210	550	1.03	2.71
Interinsular RLS	129	372	1,530	2.88	11.86
Local vessels	8	16	42	2.00	5.25
Sailing vessels	204	426	1,174	2.09	5.75
Total	10,191	16,754	28,951	1.64	2.84

Table 6-50 Estimation of DWT by Type of Vessel at the Port of Balikpapan (Public Berth)

(Unit: 1,000 DWT)

Type of Vessel	1978	1985	2000	Increase	
				1985/1978	2000/1978
Ocean going vessels					
General	–	1,650	3,520	–	–
RLS (Singapore route)	42	180	390	4.29	9.29
Domestic trade vessels					
Interinsular RLS	129	372	1,530	2.88	11.86
Local vessels	8	16	42	2.00	5.25
Sailing vessels	204	426	1,174	2.09	5.75
Total	383	2,644	6,656	6.90	17.38

6-4 Projection of the Number of Passengers

As mentioned in 4-3-2, the number of embarking and disembarking passengers in 1977 was 8,700, of which disembarking passengers occupied a majority of 7,700. They were mostly transmigrants from Java.

Assuming that the number of embarking and disembarking passengers at the Port of Balikpapan will increase in proportion to the increase of transmigrants into East Kalimantan, embarking and disembarking passengers in 1985 and in 2000 are estimated at about 9,000 and about 15,000 respectively.

Table 6-51 shows the number of embarking and disembarking passengers at the Port of Balikpapan and the number of transmigrants into East Kalimantan from 1973 through 1976.

Let "x" equal the number of transmigrants; let "y" equal the number of passengers (unit: 1000). By the least squares method, the following equation is obtained. $y = 0.083 x + 4.41$ Correlation coefficient $\gamma = 0.95$

Based on the population growth rate planned by the provincial government, the population growths in East Kalimantan 1984/85 and 1999/2000 are estimated to be 84,000 and 208,000 respectively. As about 60% of the population growth from 1970 to 1977 is considered to be due to the increase of transmigration (average annual rate of population growth from 1970 to 1977 is 5.6%, of which natural increase is estimated to be 2.5% and increase of transmigration 3.1%), 60% of the population growth in 1984/85 and 1999/2000 is assumed to be due to the increase of transmigration. Therefore, the population growth by transmigration is estimated to be 50,000 in 1984/85 and 125,000 in 1999/2000.

By replacing x with the above numbers, embarking and disembarking passengers are estimated to be about 9,000 in 1985 and about 15,000 in 2000.

Table 6-51 Number of Embarking and Disembarking Passengers at the Port Balikpapan and Number of Transmigrants into East Kalimantan

(Unit: 1,000 persons)

Year	Number of Passengers	Number of Transmigrants
1973	7.8	32.7
1974	5.3	13.1
1975	8.4	51.4
1976	6.4	26.7

Note: made from Table 2-4 and Table 4-26

Chapter 7
Long-Term Development Plan

CHAPTER 7
LONG-TERM DEVELOPMENT PLAN

7-1 Scale of the Port

As mentioned in 6-2, the volume of cargo handled at ADPEL is estimated to increase from 130 thousand tons (foreign trade : 20 thousand tons, domestic trade : 110 thousand tons) in 1978 to 611 thousand tons (foreign trade : 345 thousand tons, domestic trade : 266 thousand tons) in 1985 and to, 1,460 thousand tons (foreign trade : 729 thousand tons, domestic trade : 731 thousand tons) in 2000. (Table 6-36)

For the above estimated volume, throughput of wharf in 1985 and 2000 is estimated from PELITA II and PELITA III as shown in Table 7-1 and the required length of the berth in 1985 and in 2000 is obtained as shown in Table 7-2.

Table 7-1 Projected Cargo Throughput in the Port of Balikpapan

Unit: t/m

Year	Foreign Trade[1]	Domestic Trade		
		Interinsular	Local and Sailing	
			at Wharf	at Jetty
1978	495 (Average)[2]			140[3]
1985	900	700	500	140
2000	1,000	900	600	140

Note: 1) Including RLS (Singapore route)
2) 96 thousand tons of cargo handled at the existing concrete wharf divided by 194m.
3) 34 thousand tons of the volume of cargo handled at the existing jetty of Kampung Baru divided by the length of berth of the jetty, 240m (Fig. 7-1).

Table 7-2 Required Public Berth Length

Cargo Category \ Item / Year			1979	1980	1985	2000
			Present Berth Length	Present Berth Length	Required Berth Length	Required Berth Length
Foreign Trade			–	–	353m	651m
Interinsular			194m	271.6m[1]	266m	569m
Domestic Trade	Local and Sailing	at Wharf			–	72m
		at Jetty	240m[2]	240m[2]	571m	1,257m
Total (excluding Jetty)			194m	271.6m	619m	1,298m

Note: 1) Including 77.6 m to be constructed in 1979.
2) The available berth length of the existing jetty of Kampung Baru (Fig. 7-1).
3) See 7-1-1 for details of calculation of the necessary length of the berth.

Of the cargo handled at ADPEL, the volume of cargo using transit sheds and open storage yards is estimated as shown in Table 7-3, using as reference the percentage of use of those facilities at the Port of Surabaya for foreign trade cargo and that at the Ports of Surabaya and Samarinda for domestic trade cargo.

Table 7-3 Estimation of the Volume of Cargo using Sheds or Open Storage Yards

Unit: 1,000 tons

Year / Item / Cargo Category	1985		2000	
	Cargo using Sheds	Cargo using Open Storage Yards	Cargo using Sheds	Cargo using Open Storage Yards
Foreign Trade	233	58	458	114
Domestic Trade	93	56	321	192

Note) See 7-1-2 for details of calculating cargo using sheds and open storage yards.

Using the volume of cargo in Table 7-3, the required areas of sheds and open storage yards are obtained as in Table 7-4, assuming the rotation, the quantity of cargo storage per unit area and the cargo storage ratio.

The volume of motor traffic generated from the port (ADPEL controlled area), excluding the Kampung Baru area, is estimated in the peak hour to be about 550 cars/hour in 1985 and about 1400 cars/hour in 2000.

The terminal site area of the port controlled by ADPEL is required for 10.6 to 17.7 ha. in 1985 and 27.4 to 45.7 ha. in 2000, assuming the volume of cargo handled per 1 ha. of area is 30 to 50 thousand tons. (excluding Kampung Baru area).

Table 7-4 Required Area of Transit Sheds and Open Storage Yards

Unit: m^2

Year / Item / Cargo Category	1985		2000	
	Transit Sheds	Open Storage Yards	Transit Sheds	Open Storage Yards
Foreign Trade	7,500	1,600	14,700	3,100
Domestic Trade	1,500	800	5,100	2,600

7-1-1 Required Length of the Berth

As mentioned in 6-2, the volume of cargo handled at ADPEL is estimated to increase from 130 thousand tons (foreign trade : 20 thousand tons, domestic trade : 110 thousand tons) in 1978 to 611 thousand tons (foreign trade : 345 thousand tons, domestic trade : 266 thousand tons) in 1985 and to 1,460 thousand tons (foreign trade : 729 thousand tons, domestic trade : 731 thousand tons) in 2000. Also as mentioned in 6-3, of these cargoes, foreign trade cargoes are carried by general ocean-going vessels and RLS and domestic trade cargoes are carried by Interinsular RLS, local vessels and sailing vessels, and their each volume is estimated to be as shown in Table 6-47.
With regard to throughput of wharf, a target is set at 800 to 900 t/m for PELITA II and it is set as shown in Table 7-5 for PELITA III.

Table 7-5 Target Values of throughput of Wharf in 1983

Unit: t/m

Class	Target Value
Port handling over 1,000 thousand tons of cargo/year	900
Port handling 500 to 1,000 thousand tons of cargo/year	800
Port handling 250 to 500 thousand tons of cargo/year	700
Port handling less than 250 thousand tons of cargo/year	450

With regard to throughput of wharf at the Port of Balikpapan in 1985, a target is set at 900 tons/m with foreign trade berths to achieve the same throughput as large ports handling over 1000 thousand tons of cargo/year and with domestic trade berths 700 tons/m for Interinsular and 500 tons/m for local vessels and sailing vessels (except the jetty at Kampung Baru) as shown in Table 7-5.
In 2000, each target value is estimated to increase somewhat. Table 7-1 shows these values. With regard to the jetty at Kampung Baru, 140 tons/m of throughput in 1978 is assumed to remain unchanged in 1985 and 2000.
The necessary length of berths in 1985 and 2000 is calculated by Table 6-47 and Table 7-1 as follows.

(1) 1985

1) Foreign Trade Berth

As included in 345 thousand tons of cargo handled is 54 thousand tons of palm oil, the volume of cargo converted to general cargo is

$(345 - 54) + 54/2 = 318$ thousand tons

Therefore, the necessary length of berth is

$318{,}000/900 = 353$ m

2) Domestic Trade Berth

a) Berth for Interinsular

$186{,}000/700 = 266$ m

b) Berth for local vessels and sailing vessels

The volume of cargo carried by local vessels and sailing vessles is estimated at 80,000 tons (see Table 6-47) and if all of this volume is to be handled at the jetty of Kampung Baru, the necessary length of berth will be

$80{,}000/140 = 571$ m

An expansion plan of the jetty in Kampung Baru areas is being presently formulated and if the expansion is completed in 1985 and its use is assumed as shown in Fig. 7-1, the length of berth will be 580 m and 80,000 tons of cargo will be entirely handled at the jetty of Kampung Baru.

(2) 2000

1) Foreign Trade Berth

Included in 729 thousand tons of cargo handled is 157 thousand tons of palm oil and the volume of cargo converted to general cargo is

$(729-157) + 157/2 = 651$ thousand tons

Therefore, the necessary length of berth is

651,000/1,000 = 651 m

2) Domestic Trade Berth

a) Berth for Interinsular

512,000/900 = 569 m

b) Berth for local vessels and sailing vessels

The volume of cargo carried by local vessles in estimated at 43 thousand tons (see Table 6-47).

If all of this volume is to be handled at Site-2, the necessary length of berth will be

43,000/600 = 72 m

The volume of cargo carried by sailing vessels is estimated at 176 thousand tons (see Table 6-47).

If all of this volume is to be handled at the jetty of Kampung Baru, the necessary length of berth will be

176,000/140 = 1,257 m

If the prospective use of the jetty at Kampung Baru is assumed as shown in Fig. 7-2, the length of berth in 622 m. Accordingly another jetty for sailing vessels is necessary to be arranged. Prospective site of this new jetty is to be Kampung Baru or Penajam.

7-1-2 Required Area of Transit Sheds and Open Storage Yards

Of the cargo handled at ADPEL, the volume of cargo using transit sheds and open storage yards is estimated as follows.

(1) Foreign Trade Cargo

Foreign trade cargoes will not be directly loaded on trucks, as they must be cleared through customs.

As there was no data available at the Port of Balikpapan to show the using share of the sheds or open storage yards in the past, the record of using these facilities at the Port of Surabaya was referred.

The average using share of these facilities at the Port of Surabaya from 1970 to 1977 is 56.3 % transit sheds, 12.0% open storage yards, 21.6% directly on trucks, 9.5% silo and 0.6% pipeline. If loading directly on trucks, silo and pipeline are excluded, this average using share is 83% transit sheds, 17% storage yards.

1) 1985

Of 345 thousand tons of foreign trade cargo, excluding 54 thousand tons of palm oil, the cargo using transit sheds and that using open storage yards are estimated as follows.

Transit shed: (345 -54) x 0.8 = 233 thousand tons

Open storage yard: (345-54) x 0.2 = 58 thousand tons

2) 2000

Of 729 thousand tons of foreign trade cargo, excluding 157 thousand tons of palm oil, the cargo using transit sheds and that using open storage yards are estimated as follows.

Transit shed: (729−157) x 0.8 = 458 thousand tons

Open storage yard: (729−157) x 0.2 = 114 thousand tons

(2) Domestic Trade Cargo

For domestic trade cargoes, the using ratio of these facilities at the Port of Surabaya and Samarinda was referred.

The average using share of these facilities at the Port of Surabaya from 1970 to 1977 was as previously shown and excluding silo and pipeline it was 63% transit shed, 13% open storage yard and 24% directly on trucks.

The average using share of these facilities at the Port of Samarinda in 1977 and 1978 was 42% transit shed, 36% open storage yard and 22% directly on trucks.

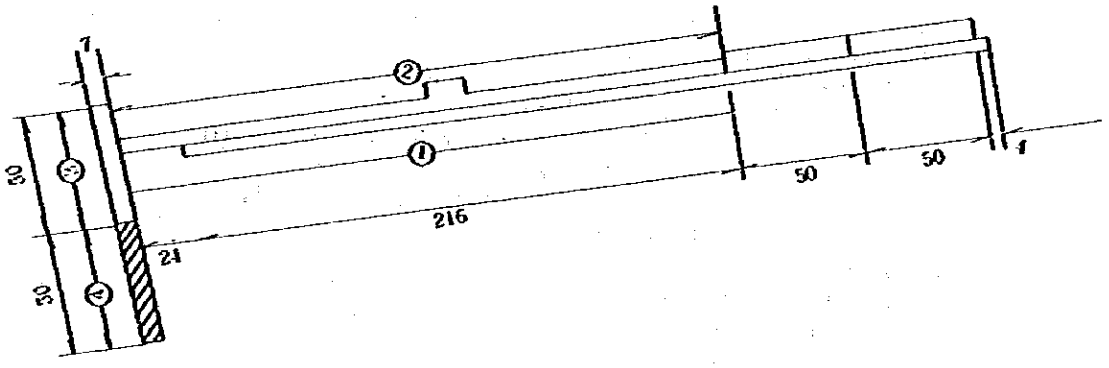
1) 1985

Of 266 thousand tons of domestic trade cargo, excluding 80 thousand tons handled at Kampung Baru, the cargo using transit sheds and that using open storage yards are estimated as follows.

Transit shed: (266−80) x 0.5 = 93 thousand tons

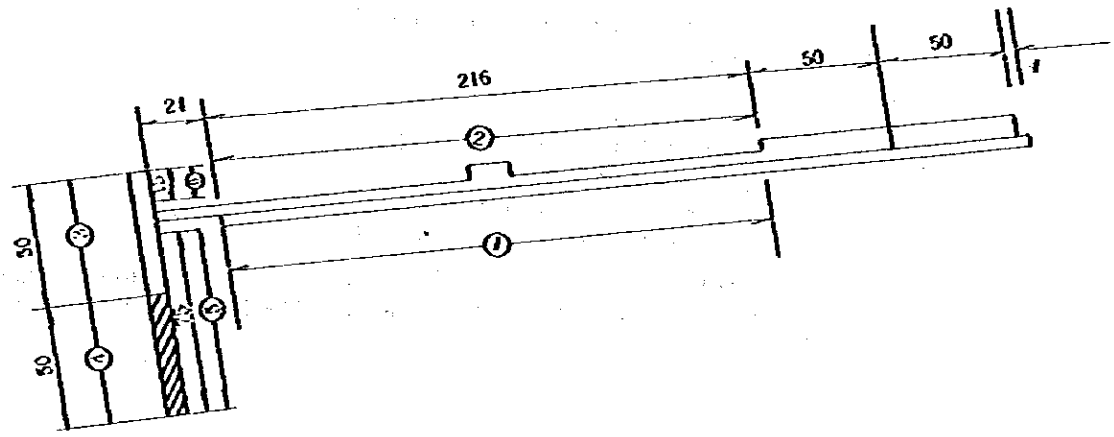
Open storage yard: (266−80) x 0.3 = 56 thousand tons

Fig. 7-1 Prospective Use of the Jetty at Kampung Baru (1985)



Note 1) When vessels are moored lengthwise at the jetty, in 1985 they can be moored at (1), (2), (3) and (4) in the Figure. The length will be
240 + 240 + 50 + 50 = 580 m
2) In 1978, mooring was possible only at (1) in the Figure, accordingly the length of the berth was 240 m.
3) The shaded portion of the figure represents the area currently projected.

Fig. 7-2 Prospective Use of the Jetty at Kampung Baru (2000)



Note 1) When ships are moored lengthwise at the jetty, in 2000 they can be moored at (1), (2), (3), (4), (5) and (6) in the Figure. The length will be
216 + 216 + 50 + 50 + 75 + 15 = 622 m
2) The shaded portion of the figure represents the area currently projected.

2) 2000

Of 731 thousand tons of domestic trade cargo, excluding 90 thousand tons handled at Kampung Baru, the cargo using transit sheds and that using open storage yards are estimated as follows.

Transit shed: (731−90) x 0.5 = 321 thousand tons

Open storage yard: (731−90) x 0.3 = 192 thousand tons

Based on the foregoing results, the areas required for transit sheds and open storage yards are obtained by the following formula.

$S = N/R\alpha W$

Where, S: required area (m^2)
N: annual cargo volume using the related facilities (t)
R: rotation (times/year)
W: quantity of cargo storage per unit area (t/m^2)
α: cargo storage ratio

(1) 1985

1) For foreign trade cargo

a) Transit shed

$R = 26^*, W = 2, \alpha = 0.6$

$S = 233,000/(26 \times 0.6 \times 2) = 7,500m^2$

b) Open storage yard

$R = 26^*, W = 2, \alpha = 0.7$

$S = 58,000/(26 \times 0.7 \times 2) = 1,600m^2$

2) For domestic trade cargo

a) Transit shed

$R = 52^*, W = 2, \alpha = 0.6$

$S = 93,000/(52 \times 0.6 \times 2) = 1,500m^2$

b) Open storage yard

$R = 52^*, W = 2, \alpha = 0.7$

$S = 56,000/(52 \times 0.7 \times 2) = 800m^2$

(2) 2000

1) For foreign trade cargo

a) Transit shed

$R = 26^*, W = 2, \alpha = 0.6$

$S = 458,000/(26 \times 0.6 \times 2) = 14,700m^2$

b) Open storage yard

$R = 26^*, W = 2, \alpha = 0.7$

$S = 114,000/(26 \times 0.7 \times 2) = 3,100m^2$

2) For domestic cargo

a) Transit shed

$R = 52^*, W = 2, \alpha = 0.6$

$S = 114,000/(26 \times 0.7 \times 2) = 5,100m^2$

b) Open storage yard

$R = 52^*, W = 2, \alpha = 0.7$

$S = 192,000/(52 \times 0.7 \times 2) = 2,600m^2$

* According to ADPEL of Balikpapan, cargo duration period is 2 weeks for foreign cargo storage and 1 week for domestic cargo storage. Therefore, R = 365/14 = 26 for foreigh trade cargo and R = 365/7 = 52 for domestic trade cargo.

7-1-3 Planned Traffic Volume

The planned traffic volume generated from the port area (area controlled by ADPEL) is obtained by the following formula.

Planned traffic volume (cars/hour) = $C/W \times \beta/12 \times \gamma/\S_0 \times (1+\delta)/\epsilon \times \sigma$

Where, C: cargo transported by car (freight tons/year)
W: actually loaded truck cargo volume (freight tons/truck)
β: monthly rate of variation = cargo volume in peak month/average monthly cargo volume
γ: daily rate of variation = cargo volume on peak day/average daily cargo volume
$\S_0$: average number of days operated in a month
δ: rate of related cars = number of related cars/total number of trucks
ϵ: rate of actually loaded cars = number of trucks loaded with cargo/total number of trucks
σ: rate of time change = traffic volume generated at peak hours/traffic volume generated per day

In this study, W=2, β=1.2, γ=1.5, $\S_0$=25, δ=0.5, ϵ=0.5, σ=0.16

(1) 1985

Of 345 thousand tons of foreign trade cargo, 167 thousand tons are transported to inland by trucks after imported and 104 thousand tons are exported after transported by trucks from inland.

Of 266 thousand tons of domestic trade cargo, 167 thousand tons are transported to inland after brought in (of which 56 thousand tons at Kampung Baru) and 25 thousand tons are shipped out after transported in from inland by trucks (of which 24 thousand tons at Kampung Baru).

Therefore, the volume of cargo transported in and out by trucks from port areas other than Kampung Baru is

$167 + 104 + (167 - 56) + (25 - 24) = 383$ thousand tons

Therefore, the planned traffic volume is

$383{,}000/2 \times 1.2/12 \times 1.5/25 \times (1+0.5)/0.5 \times 0.16 = 552$ cars/hour

As the volume of cargo transported in and out by trucks from Kampung Baru is 80 thousand tons, the planned traffic volume is

$80{,}000/2 \times 1.2/12 \times 1.5/25 \times (1+0.5)/0.5 \times 0.16 = 115$ cars/hour

(2) 2000

Of 729 thousand tons of foreign cargo, 296 thousand tons are transported to inland by trucks after imported and 266 thousand tons are exported after transported from inland by trucks.

Of 731 thousand tons of domestic trade cargo, 526 thousand tons (of which 138 thousand tons at the jetties for sailing vessels) are transported to inland by trucks after brought in and 38 thousand tons (of which 38 thousand tons at the jetties for sailing vessels) are shipped out after transported in from inland by trucks.

Therefore, the volume of cargo transported in and out by trucks from port areas other than the jetties for sailing vessels is

$296 + 266 + (526 - 138) + (38 - 38) = 950$ thousand tons

Therefore, planned traffic volume is

$950{,}000/2 \times 1.2/12 \times 1.5/25 \times (1+0.5)/0.5 \times 0.16 = 1{,}368$ cars/hour

As the volume of cargo transported in and out by trucks from the jetties for sailing vessels is 176 thousand tons, the planned traffic volume is

$176{,}000/2 \times 1.2/12 \times 1.5/25 \times (1+0.5)/0.5 \times 0.16 = 253$ car/hour

7-2 Arrangement Plan of Port Facilities and Utilization Plan of the Bay of Balikpapan

The length and the number of public berth to be constructed in 1980 to 85 and 1980 to 2000 in consideration of largest vessel by type of vessels mentioned in 6-3, corresponding to the required length of public berth shown in the Table 7-2, will be as shown in the Table 7-6.

In 1980 to 1985, two –9m berths (length 330 m) must be constructed as foreign trade berth and expansion of the jetty (length 50 m) of Kampung Baru for local vessels and sailing vessels as domestic trade berth must be made.

Also in 1980 to 2000, including the berths to be constructed in 1980 to 85, as foreign trade berth, two – 9m berths (length 330 m) and two – 10m berths (length 370 m) must be constructed and as domestic trade berth, three –6m berths (length 315 m) for Interinsular vessels and 150 m of –4m berth for local vessels must be constructed and the jetty at Kampung Baru must be extended (length 50 m). And the new jetty for sailing vessels must be constructed at Kampung Baru or Penajam.

The areas of transit sheds and open storage yards to be constructed newly, corresponding to the required areas of transit sheds and open storage yards shown in the Table 7-4, will be as shown in the Table 7-7.

The basic policies for establishing arrangement plan of these public port facilities are as follows.

(1) To maintain functional relations with the existing facilities
(2) To secure sufficient site areas for wharf and port
(3) To consider soil conditions and water depth
(4) To make available each berth by specific types of ships.
(5) To consider maneuver of vessels
(6) To consider traffic to/from hinterland
(7) To consider the total utilization plan of the Bay of Balikpapan
(8) To consider expansion plans after 2000

Based on the foregoing policies, after a comparative study of Site 2 (Bay entrance) and Site 4 (Tg. Makasar), Site 2 has been selected as a site for the public port facilities upto 2000 and port facilities arrangement plan upto 2000 has been prepared as shown in Fig. 7-3.

Fig 7-4 shows a total utilization plan of the Bay of Balikpapan at that time.

7-2-1 Site for Constructing Public Berth

As mentioned in Chapter 5, as site for constructing the public berth, Site 2 (entrance of the bay) and Site 4 (Tg. Makasar) are considered. As a result of the study it was found that construction and arrangement of basic port facilities required in 2000 would be possible both at Site 2 and Site 4.

However, following problems will be encountered in constructing new port facilities at Site 4.

Firstly, there is no concentration of population in the hinterland at present, access roads must be constructed for distributing cargo in the hinterland or for collecting cargo from the hinterland.

Secondly, it is considered difficult to make greater expansion than that shown in Fig.7-13 against building a wharf at the site of –10 m to –13m as well as to avoid the deposit of earth and sand flowed from the rivers on the east side.

On the other hand, the following problems will be encountered in case of Site 2.

Firstly, it will be necessary to remove the reef in front of the existing public berth in view of handling vessels.

Secondly, the expansion of the port will create a larger traffic volume from the port and may affect the traffic of the City of Balikpapan.

Thirdly, expansion to meet demand after 2000 will be difficult.

While Sites 2 and 4 have these problems, the difficulty of expansion is the same for both Sites 2 and 4. For the problem of removing the reef for Site 2, there is the problem of constructing road posed for Site 4. Here, the remaining problem, or the traffics generated from the port, will be discussed below.

Now, referring to the traffic volumes generated from the port in 1985 and 2000 stated in paragraph 7-1-3, they are distributed to the roads in each case of thy port constructed at Site 2 and at Site 4, as shown in Figs. 7-5 to 7-8.

As seen from Figs. 7-5 and 7-6, in 1985, whether the port is constructed at Site 2 or Site 4, it scarcely affects the road traffic. But, in 2000, the port constructed at Site 2 will have a considerable effect on the road traffic in the vicinity of Site 2, and the port constructed at Site 4 will have a considerable effect on the road traffic in the north of the present urban area, as shown in Figs. 7-7 and 7-8. Thus, whether the port is constructed at Site 2 or Site 4, the existing road will have to be expanded (although the place of expansion is different).

It is of course interesting to attempt a cost-benefit analysis including the item of influence on road traffic in 2000 to see which one of Sites 2 and 4 is preferable to the other. But, it is very dangerous to make such cost-benefit analysis upon the limited data currently availabel for decision making of the investment in 2000 or more than 20 years ahead. Thus, here, the cost-benefit analysis will be made of the expansion project having the year of 1985 as a target year when such project is made at Site 2 as well as Site 4.

In Table 7-6 are shown the construction costs (to be used in economical analysis) at Sites 2 and 4. For increments of the management and operation expense, see Chapter 11.

In Table 7-7 are also shown the benefits when the port is constructed at Site 2 or 4.

While the details of the benefit calculation will be described in Chapter 11, if the port construction is made at Site 4, the foreign trade pier is located at Site 4, while the domestic trade pier at Site 2, so that there is to be counted as negative benefit the expense of land transport between Sites 2 and 4 of the cargos imported at Site 4 and exported domestically from Site 2 and those imported domestically at Site 2 and exported from Site 4.

Such negative benefit is calculated, in use of the unit cost of land transport in East Kalimantan at 50 RP/ton-km, distance between Sites 2 and 4 at 30km and the related cargo volumes, as

1984: 23,000 tons x 30km x 50Rp = 34,500,000Rp = 55,000 US$.

In and after 1985: 74,000 tons x 30km x 50Rp = 111,000,000Rp = 178,000 US$.

For these costs and benefits, the present values were obtained in use of a discount rate of 12%, and the benefit-to-cost ratios were calculated as 1.1 for Site 2 and 0.92 for Site 4 (See Tables 7-8 and 7-9).

Accordingly, the port expansion is thus to be made at Site 2.

7-2-2 Port Facilities Plan

(1) Mooring Facilities Plan

As mentioned in 6-3, the largest size of vessels by type of vessel for the respective year is as shown in Table 7-12 following.

On the other hand, Table 7-6 shows the number and the water depth of berth to be constructed. These are obtained by reducing the existing length of berth from Table 7-2, in consideration of Table 7-12.

As shown in Fig. 7-3, three berths for Interinsular (105 m x 3 = 315 m) and 150 m berth for local vessels are to be constructed on the extension of the existing berths (including 77.6 m to be constructed in 1979) and four foreign trade berths (165 m x 2 + 185 m x 2 = 700 m) are to be constructed next to the basin for official boats and ferry boats.

The berth for ferry boats is to be constructed for traffic with Penajam, opposite the port.

The face line of the wharf is set to insure the depth f water shown in Table 7-6.

The distance between the berths of PERTAMINA and existing berth of ADPEL is about 70 m. This deistance is more than the standard of Japan. (Japanese standard of the distance between the tanker which is handling cargo and other ships, is 30 m.)

(2) Cargo,Handling Facilities and Storage Facilities Plan

Transit sheds and open storage yards are arranged behind the apron of the wharf (standard width 25 m) as shown in Fig. 7-3 as cargo handling and storage facilities.

Table 7-6 Required Public Berth Length and Berth Number

Kind of Trade	Year / Item	1979 Present Berth: Berth Length	1979 Present Berth: Berth Number	1979 Present Berth: Water Depth	1980 Present Berth: Berth Length	1980 Present Berth: Berth Number	1980 Present Berth: Water Depth	1985 Required Berth Length	1985 New Required Berth (1985–1980): Berth Length	1985 New Required Berth (1985–1980): Berth Number	1985 New Required Berth (1985–1980): Water Depth	2000 Required Berth Length	2000 New Required Berth (2000–1980): Berth Length	2000 New Required Berth (2000–1980): Berth Number	2000 New Required Berth (2000–1980): Water Depth
Foreign Trade		–	–	–	–	–	–	353m	330m	2 Berth	–9m	651m	700m	4 Berth	–9m and –10m
Domestic Trade	Interinsular	194m	2 berth as the berth for inter-insular	–8m ~ –10.5m	271.6m [1]	3 berth as the berth for inter-insular	–8m ~ –10.5m	266m	–	–	–	569m	315m	3 Berth	–6m
	Local and Sailing: at Wharf							–	–	–	–	572m	150m		–4m
	Local and Sailing: at Jetty	240m [2]		–4m	240m [2]		–4m	571m	340m [3]		–4m	1,257m	380m [3] and new jetty		–4m
Total (excluding Jetty)		194m	2 berth		271.6m	3 berth		619m	330m	2 Berth		1,298m	1,165m	7 Berth	

Note: 1) Including 77.6 m to be constructed in 1979.
2) Usable length of the existing jetty of Kampoung Baru (Fig. 7-1)
3) Usable length of the expanded jetty of the existing Kampung Baru jetty. (Fig. 7-2)

Table 7-7 Newly Required Areas of the Transit Sheds and Open Storage Yards

(Unit: m²)

Year / Item / Kind of Trade	1979		1985						2000					
			Transit shed			Open storage yard			Transit shed			Open storage yard		
	Transit shed, existing area (1)	Open storage yard, existing area (2)	required area (3)	newly required area (4)=(3)−(1)	facilities plan	required area (5)	newly required area (6)=(5)−(2)	facilities plan	required area (7)	newly required area (8)=(7)−(1)	facilities plan	required area (9)	newly required area (10)=(9)−(2)	facilities plan
Foreign Trade	-	-	7,500	7,500	build one transit sheds of 6000 m²	1,600	1,600	arrange open storage yard of over 1,600 m²	14,700	14,700	build two transit sheds of 6000 m²	3,100	3,100	arrange open storage yard of over 3,100 m²
Domestic Trade	3,200[1)]	9,000	1,500	0	no new facilities required	800	0	no new facilities required	5,100	1,900	build one transit sheds of 2000 m²	2,600	0	no new facilities required

Note 1) Total of shed 2,150 m² and warehouse 1,050 m²

Table 7-8 Construction Cost of Short Term Development Program to be Used in Economic Analysis

Works	Unit	Site 2			Site 4			Note
		Unit Price (US$)	Quantity	Amount (1,000 US$)	Unit Price (US$)	Quantity	Amount (1,000 US$)	
Foreign Trade Wharf	m	14,400	330	4,752	14,400	330	4,752	
Service Vessels Wharf	m	10,780	75	809	10,780	75	809	
Jetty	m	4,840	50	242	4,840	50	242	
Temporary Revetment	m	1,710	815	1,394	1,710	250	428	
Reclamation	m^3	1.7	905,000	1,539	6.9	324,000	2,236	
Transit Shed	m^2	297	6,000	1,782	297	6,000	1,782	
Open Storage	m^2	18	1,625	29	18	1,625	29	
Building	m^2	319	30	10	319	30	10	
Road (in the Port)	m^2	30	35,600	1,068	30	35,600	1,068	
Road (outside of the Port)	m^2	30	0	0	30	70,000	2,100	Width: 7m, Length: 10km
Others	sum			2,911			2,911	
Sub Total				14,536			16,367	
Physical Contingency (15%)	sum			2,181			2,455	
Engineering Study & Supervision	sum			1,102			1,102	
Total (to be Used in Economic Analysis)				17,819			19,924	

Table 7-9 Benefits to be used in Economic Analysis

Unit: 1,000 US$

Year	Site 2				Site 4				
	Direct Import	Ship Congestion		Total	Direct Import	Ship Congestion		Transhipment	Total
		at Site 2	at Kampung Baru			at Site 2	at Kampung Baru		
1984	1,006	211		1,217	1,006	211		Δ 55	1,162
From 1985 onward	2,933	278	210	3,421	2,933	278	210	Δ178	3,243

Table 7-10 Cost Benefit Table (In the Case of Developping Site 2)

Unit: 1,000 US$

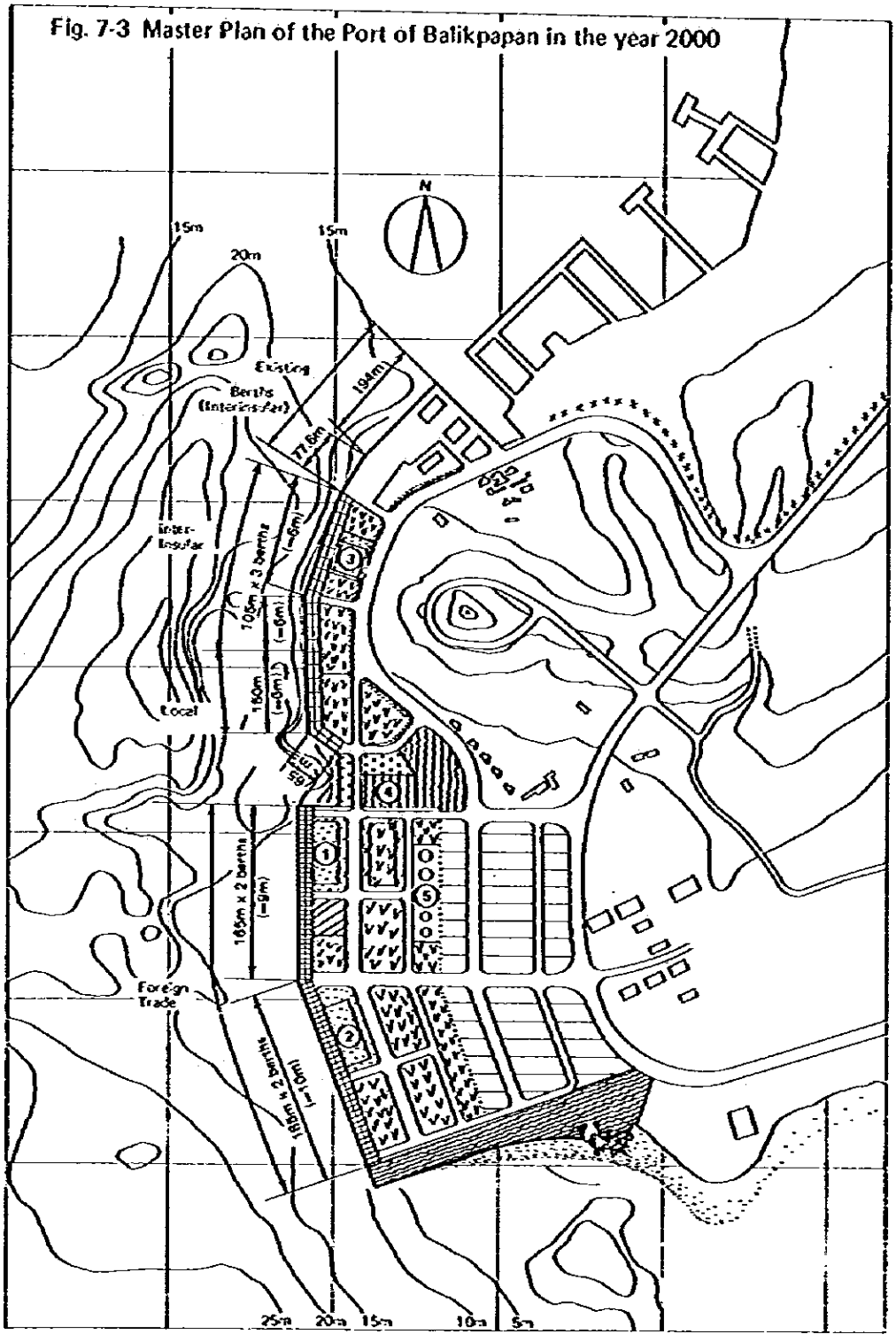
Year		Cost			Benefit	Discounted Valve (Discount Ratio=12.0%)	
		Port Investment	Maintenance & Operating for New Facilities	Total		Cost	Benefit
1	1981	1,313		1,313		1,313	
2	1982	6,930		6,930		6,188	
3	1983	4,408	141	4,549		3,626	
4	1984	5,168	229	5,397	1,217	3,841	866
5	1985		505	505	3,421	321	2,174
6	1986		505	505	3,421	287	1,941
7	1987		505	505	3,421	256	1,733
8	1988		505	505	3,421	228	1,547
9	1989		505	505	3,421	204	1,382
10	1990		505	505	3,421	182	1,234
11	1991		505	505	3,421	163	1,101
12	1992		505	505	3,421	145	983
13	1993		505	505	3,421	130	878
14	1994		505	505	3,421	116	784
15	1995		505	505	3,421	103	700
16	1996		505	505	3,421	92	625
17	1997		505	505	3,421	82	558
18	1998		505	505	3,421	74	498
19	1999		505	505	3,421	66	445
20	2000		505	505	3,421	59	397
21	2001		505	505	3,421	52	355
22	2002		505	505	3,421	47	317
23	2003		505	505	3,421	42	283
24	2004		505	505	3,421	37	252
25	2005		505	505	3,421	33	225
Total		17,819	10,975	28,794	73,058	17,687	19,278
Cost Benefit Ratio = 19,278/17,687 = 1.1							

Table 7-11 Cost Benefit Table (In the Case of Developping Site 4)

Unit: 1,000 US$

Year		Cost			Benefit	Discounted Valve (Discount Ratio=12.0%)	
		Port Investment	Maintenance & Operating for New Facilities	Total		Cost	Benefit
1	1981	3,543		3,543		3,543	
2	1982	6,404		6,404		5,718	
3	1983	4,809	141	4,950		3,946	
4	1984	5,168	229	5,397	1,162	3,841	827
5	1985		505	505	3,243	321	2,061
6	1986		505	505	3,243	287	1,840
7	1987		505	505	3,243	256	1,643
8	1988		505	505	3,243	228	1,467
9	1989		505	505	3,243	204	1,310
10	1990		505	505	3,243	182	1,169
11	1991		505	505	3,243	163	1,044
12	1992		505	505	3,243	145	932
13	1993		505	505	3,243	130	832
14	1994		505	505	3,243	116	743
15	1995		505	505	3,243	103	664
16	1996		505	505	3,243	92	592
17	1997		505	505	3,243	82	529
18	1998		505	505	3,243	74	472
19	1999		505	505	3,243	66	422
20	2000		505	505	3,243	59	377
21	2001		505	505	3,243	52	336
22	2002		505	505	3,243	47	300
23	2003		505	505	3,243	42	268
24	2004		505	505	3,243	37	239
25	2005		505	505	3,243	33	214
Total		19,924	10,975	30,899	69,265	19,767	18,281
Cost Benefit Ratio = 18,281/19,767 = 0.92							

Fig. 7-3 Master Plan of the Port of Balikpapan in the year 2000



Legends

- apron for foreign trade
- apron for domestic trade
- transit shed area
- open storage
- reserved area
- area for port management
- ferry terminal
- open space and park
- port related business area

0 100 200 300 400 500 (m)

① – ⑤ transit sheds 50 x 120 m²
⑥ transit sheds 40 x 50 m²
⑦ Site for port management office
⑧ Site for palm oil tanks

Fig. 7-4 Development Plan of the Bay of Balikpaan in the year 2000

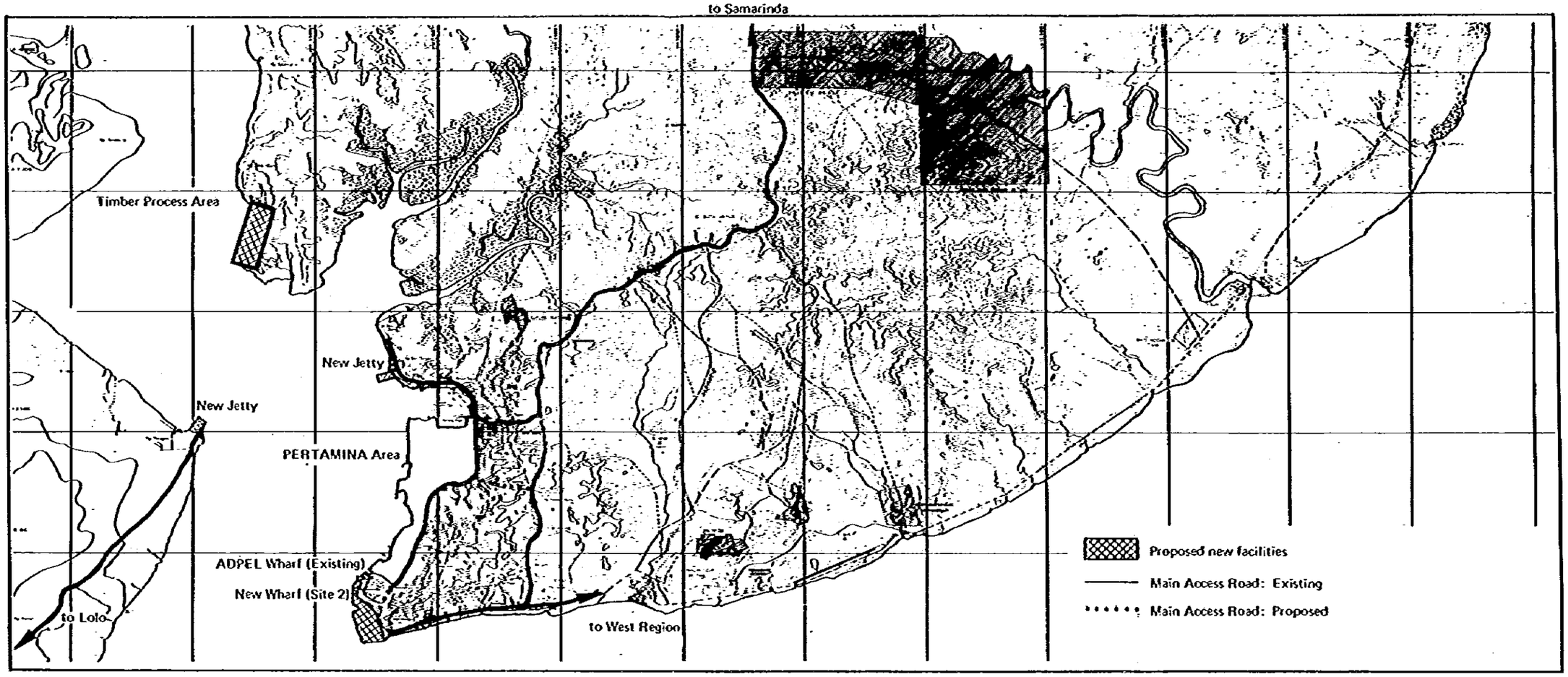
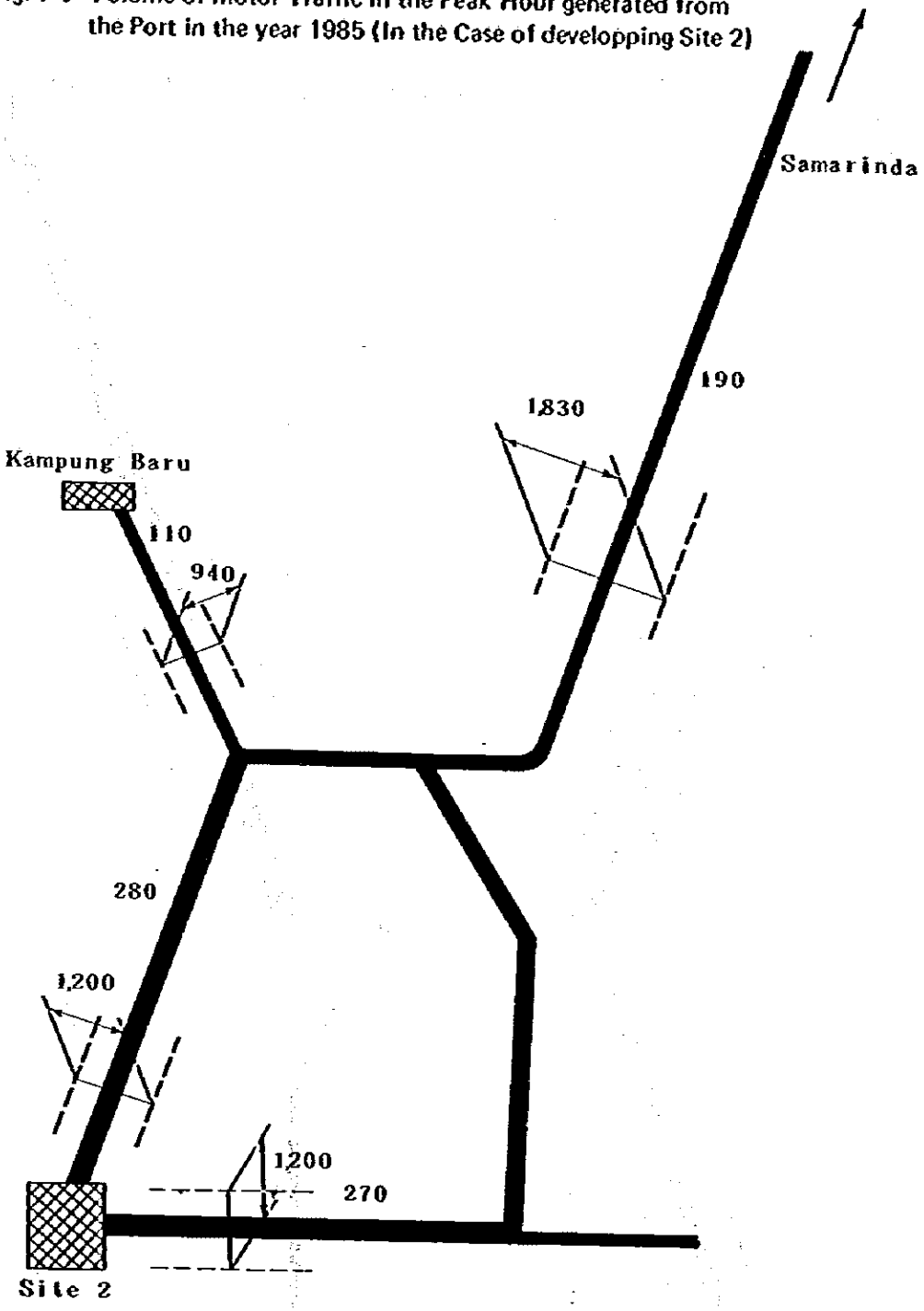


Fig. 7-5 Volume of Motor Traffic in the Peak Hour generated from the Port in the year 1985 (In the Case of developping Site 2)



Note: ; Volume of motor traffic in the peak hour generated from the port

; Possible capacity of motor traffic

Unit: cars/hours

Fig. 7-6 Volume of Motor Traffic in the Peak Hour generated from the Port in the year 1985 (In the Case of developping Site 4)

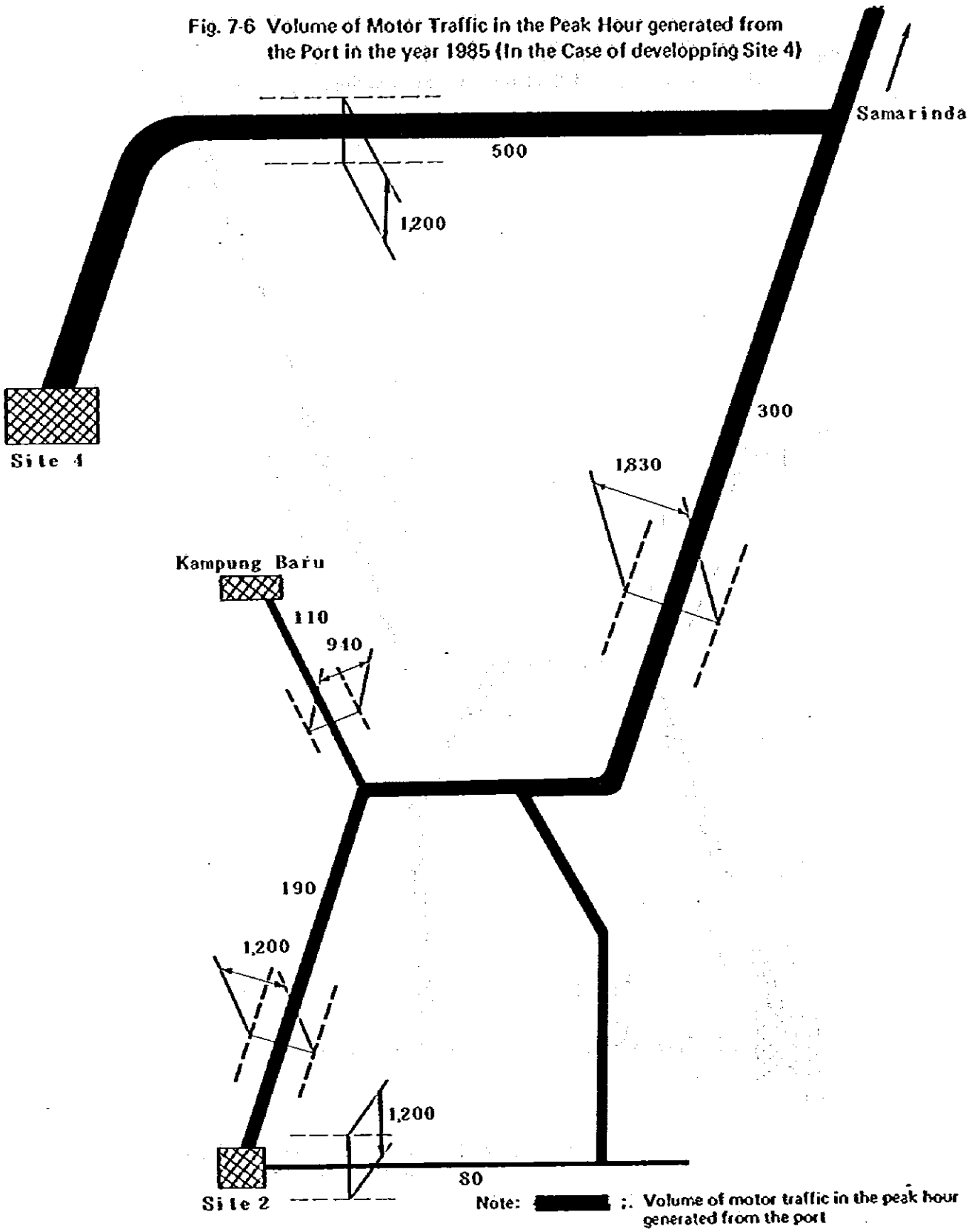
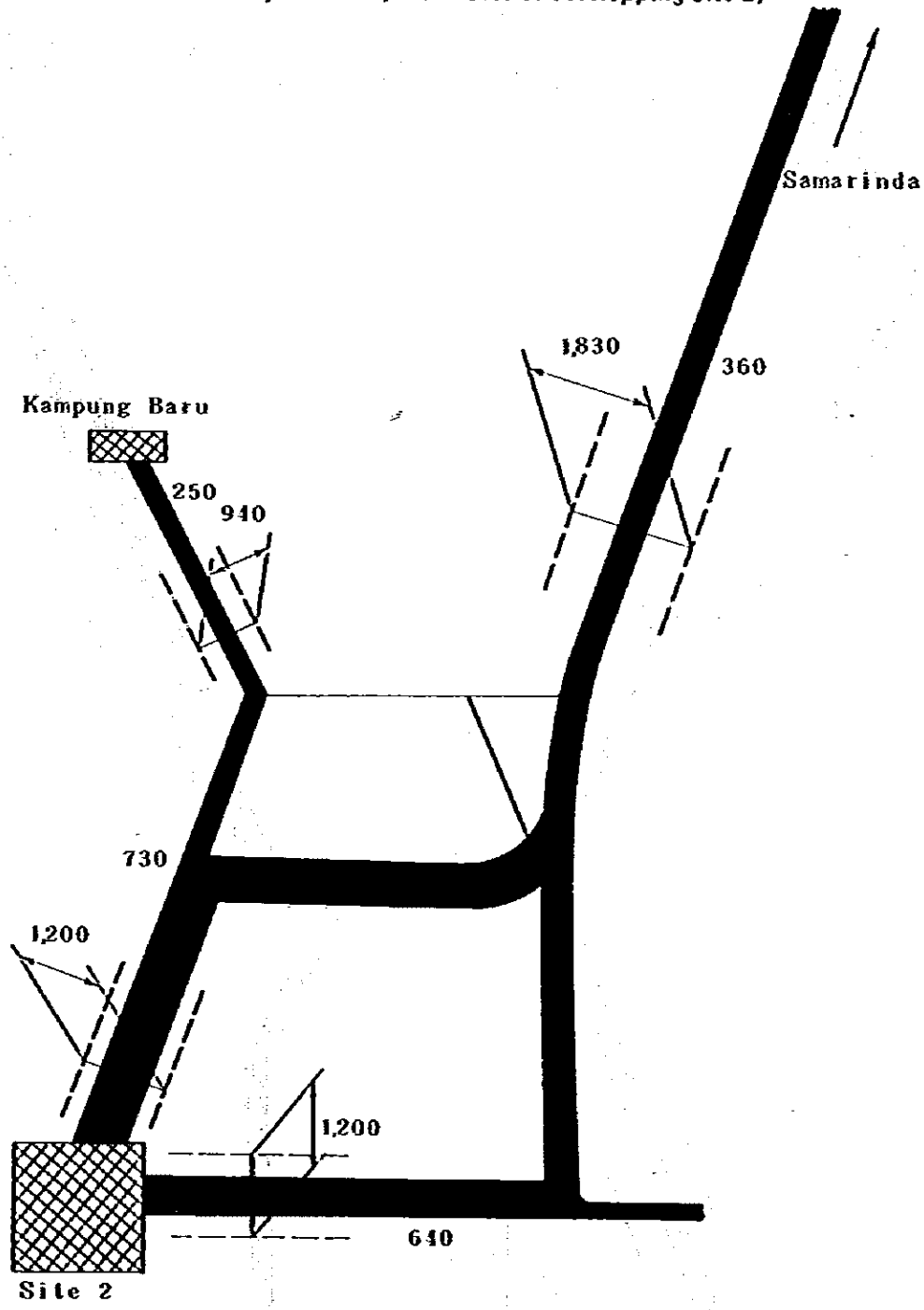


Fig. 7-7 Volume of Motor Traffic in the Peak Hour generated from the Port in the year 2000 (In the Case of developping Site 2)



Note: ▬▬ ; Volume of motor traffic in the peak hour generated from the port

- - - - ; Possible capacity of motor traffic

Unit: cars/hour

Fig. 7-8 Volume of Motor Traffic in the Peak Hour generated from the Port in the year 2000 (In the Case of developping Site 4)

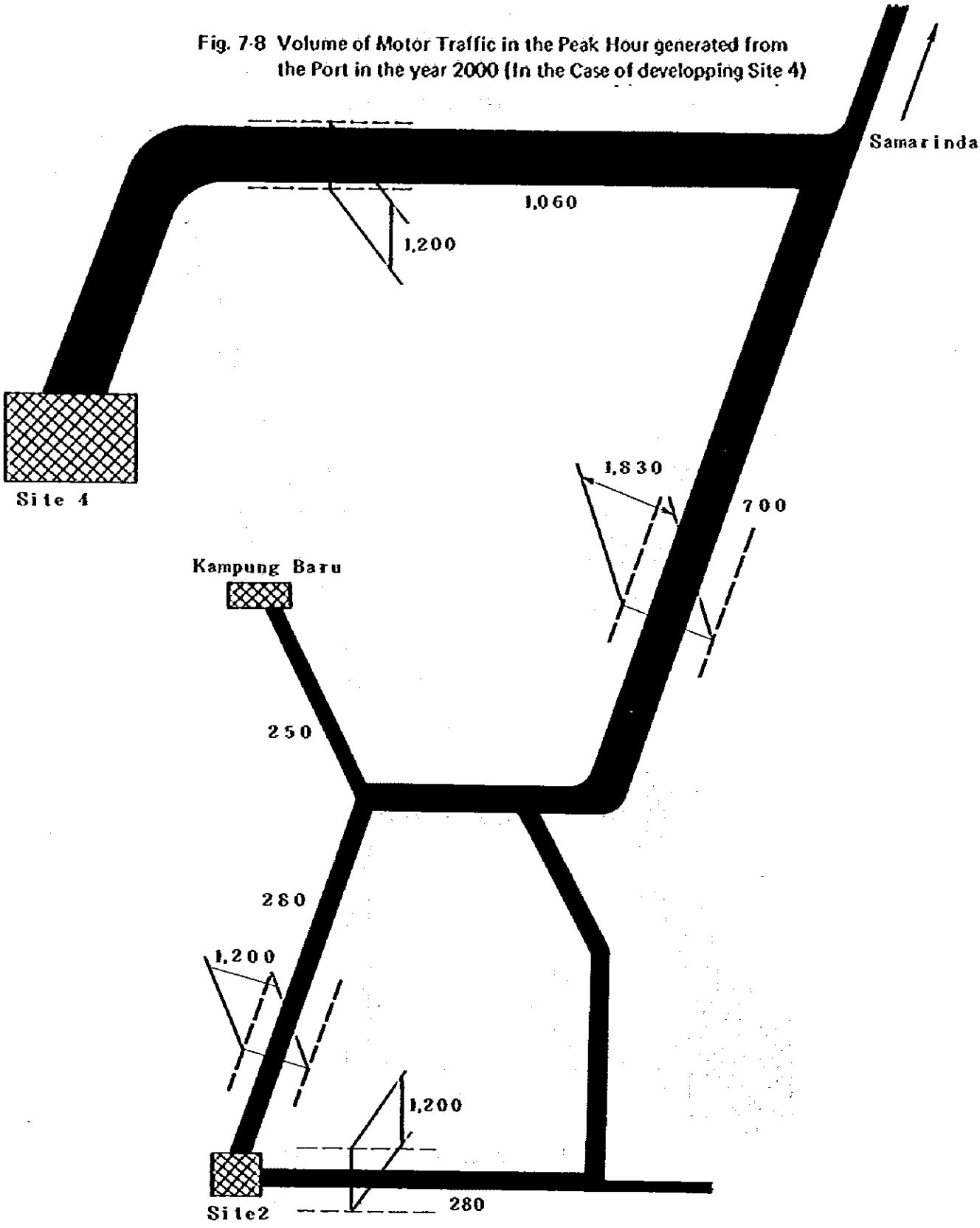


Table 7-12 Largest Size of Vessels

(Unit: DWT)

Type of vessels \ Year		1985	2000
Ocean-going vessels	General ocean-going vessels	10,000	15,000
	RLS (Singapore route)	3,000	5,000
Domestic vessels	Interinsular vessels	2,000	3,000
	Local vessels	300	500
	Sailing vessels	300	300

Required areas for new transit sheds and open storage yards are as shown in Table 7-7.
The size of the transit shed is for foreign trade shed 120m x 50m and for domestic trade shed 50m x 40m.
Warehouses are to be built by private business and only site is reserved in the port areas.
Of the foreign trade berths, behind the apron of the southernmost berth, space must be reserved for handling new types of cargo in future such as containers.

(3) Port Management Facilities Plan

As the center of the public port shifts to south from the present location in 2000, new port administration office will be built to facilitate administration and management. In the office, not only ADPEL but also the bodies concerned such as customs will be placed.
Waiting rooms for ferry and passenger waiting rooms will be planned. Also, parking place for ferry,passengers will be provided.
Security office, repair shop for cargo handling equipments and rest rooms for labour, etc. will also be adequately provided.

(4) Road Plan

The volume of traffic generated in relation to the port is not very large as mentioned in 7-1, but in order to avoid congestion with general traffic and to smoothly handle cargo, the road is arranged as shown in Fig. 7-3.
The flow of traffic related to the port will be as shown in Fig. 7-9. Fig. 7-10 shows the typical cross section for roads.

7-2-3 Land Use Plan

(1) Inside the Port Area

A land use plan inside the port area is prepared as follows.
As shown in Fig. 7-3, on the first and second lines, such facilities directly related to port activities as transit sheds and open storage yards, etc. are mainly placed (in Fig. 7-3, those facilities are placed on the first line and the second line is reserved for the future demand) and on and after the third line such facilities indirectly involved in port activities as warehouse, palm, oil tank site, etc., are mainly arranged.
Fig. 7-11 shows the typical cross section of this arrangement.
For palm oil tanks assuming the rotation of 12 times/year, two 2500 kl tanks will be required in 1985 and two 5000 kl tanks in addition to two 2500 kl tanks will be required in 2000.
At the southernmost part of the port area, a green belt is provided to maintain the beauty of the port area.

(2) Outside the Port Area

As shown in Fig. 7-3, hills behind the existing wharf are to be organized as a park for citizens for resting and having a grand view of the port.
As mentioned before, roads will be planned as shown in Fig. 7-3 to smoothly handle cargoes at the port and avoid congestion with general traffic.

7-2-4 Use Plan of Balikpapan Bay

Fig. 7-4 shows a use plan of Balikpapan Bay in 2000. The public berth will be concentrated in Site 2 mentioned before and the jetty of Kampung Baru will be used as shown in Fig. 7-2.
At Penajam opposite the port, a ferry terminals will be built for traffic with Site 2,

Fig. 7-9 Activities map in the year 2000

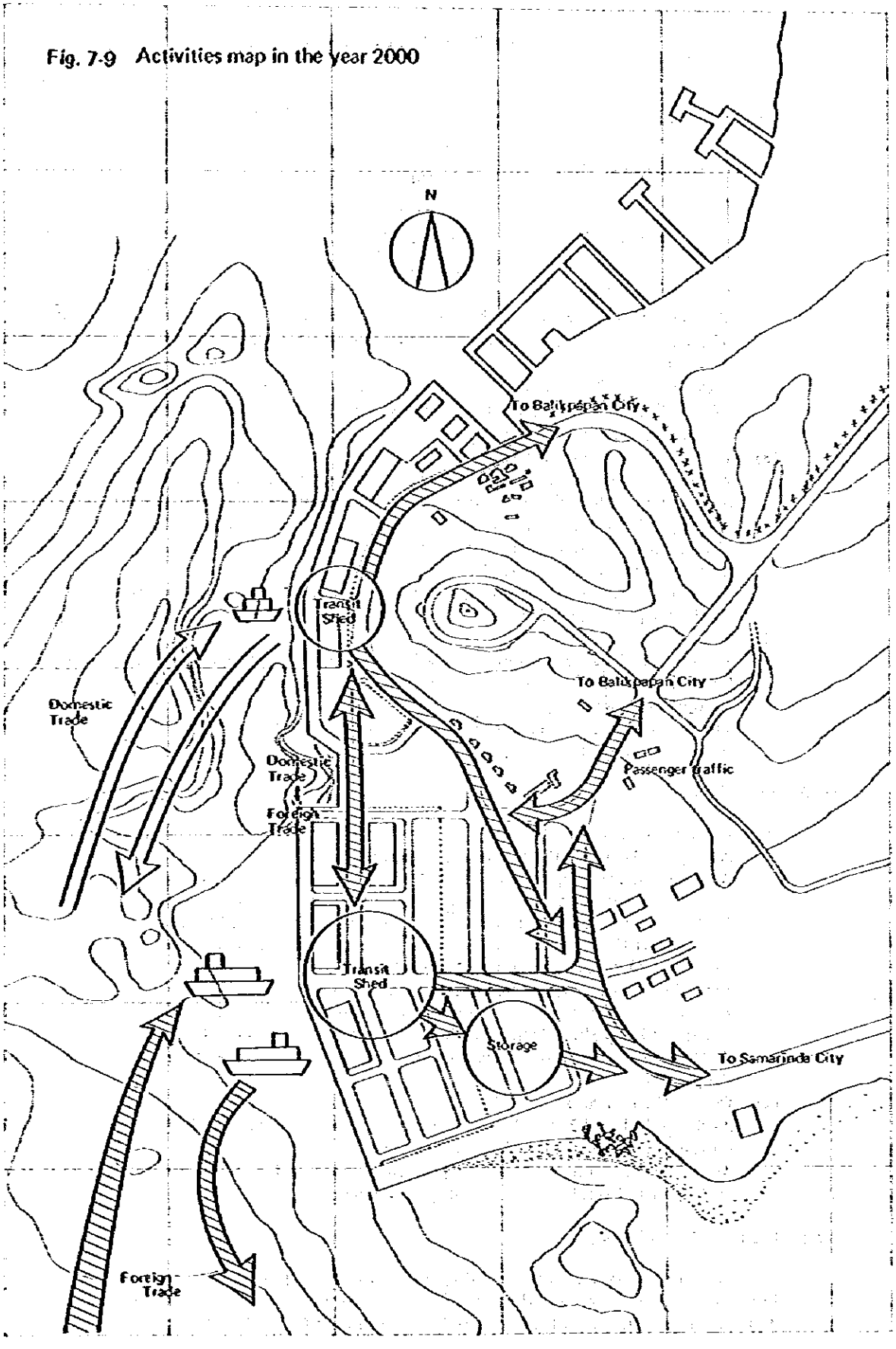
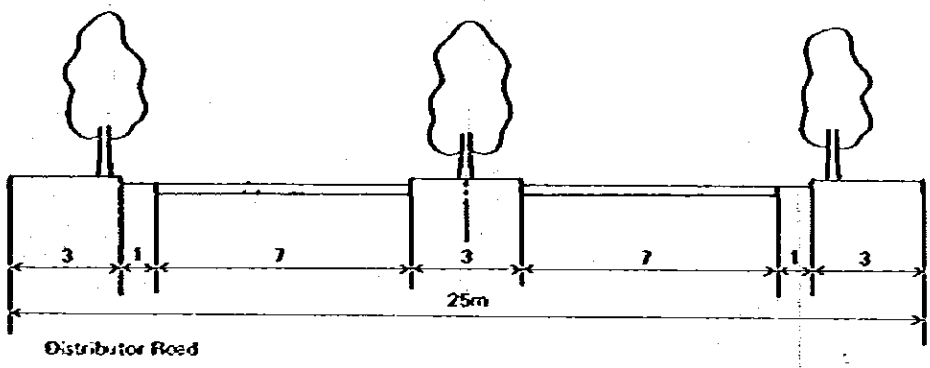
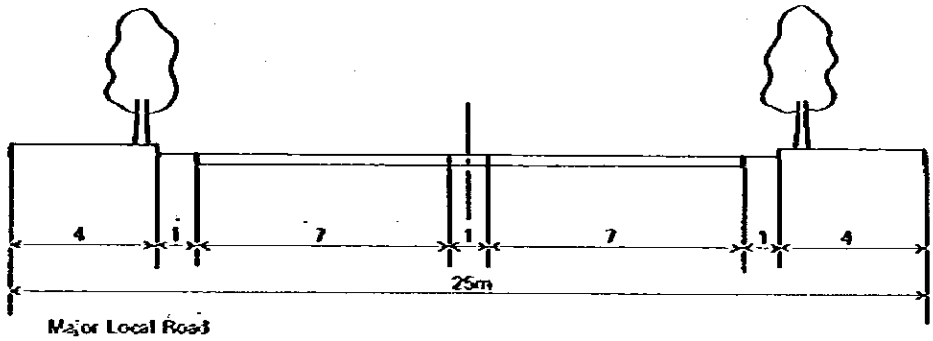


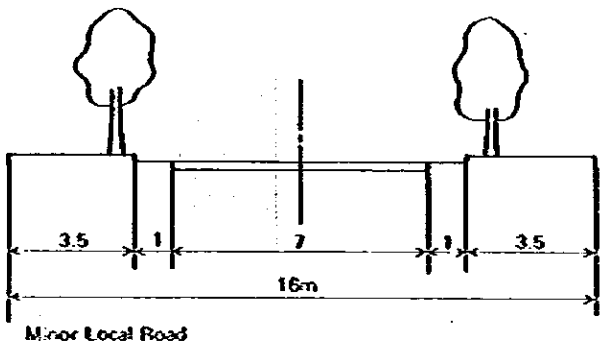
Fig. 7-10 Typical Cross Section for Roads.



Distributor Road

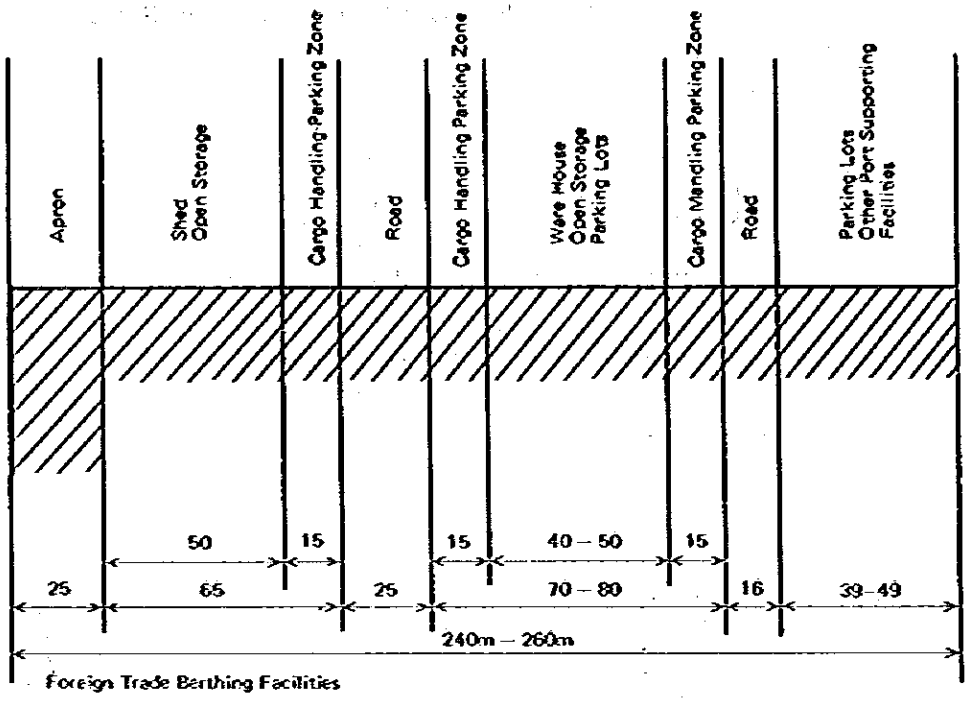


Major Local Road

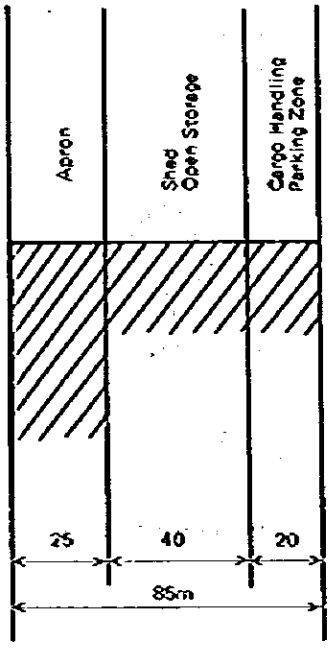


Minor Local Road

Fig. 7-11 Typical Cross Section for Berthing Facilities



Foreign Trade Berthing Facilities



Domestic Trade Berthing Facilities

As private facilities, a wharf to be used exclusively for timber will be planned at the west side of Tg. Makasar. Log brought from the interior will be made into sawn timber and shipped for export and domestic consumption.
As for port facilities of PERTAMINA, the present site will be used and expansion will be planned there.

7-3 The Use of Balikpapan Bay after 2000

Fig. 7-12 shows a use plan of Balikpapan Bay after 2000.

Public port facilities are provided at Site 4 as well as Site 2 and Site 2 is used mostly for domestic trade and Site 4 is used mostly for foreign trade. Site 4 will also have a container yard. Fig. 7-13 shows the image plan of Site 4. Coastal industries will be located in the Penajam area and exclusive port facilities will be provided.

7-3-1 Port Plan of Tg. Makasar Area (Site 4)

After 2000, berths will become short at Site 2. Only site available for new berths will be Site 4. However, as the hinterland of Site 4 does not have the concentration of population and Site 4 is far from cities, road construction to connect with trunk roads and housing construction for port personnel will be required.
When public berths are built at Site 4, Site 2 may be exclusively used for domestic trade and Site 4 exclusively for foreign trade. As it is difficult to project vessel type of foreign trade liners after 2000, the face line of the wharf is taken as in Fig. 7-13 to construct – 10m to – 13m wharf for the use by 15,000 DWT vessels snd container ships.

7-3-2 Development Plan of Coastal Industrial Area at Penajam

It is difficult to project coastal industries other than timber and oil at Balikpapan for future, as there are too many uncertainties.
If such industries (shipbuilding and petrochemical industries, etc.) requiring beach line are to be located at Balikpapan, the Penajam area may be the most appropriate.
Therefore, the costal industrial area is included in Fig. 7-12.

Fig. 7-12 Development Plan of the Bay of Balikpapan after the year 2000

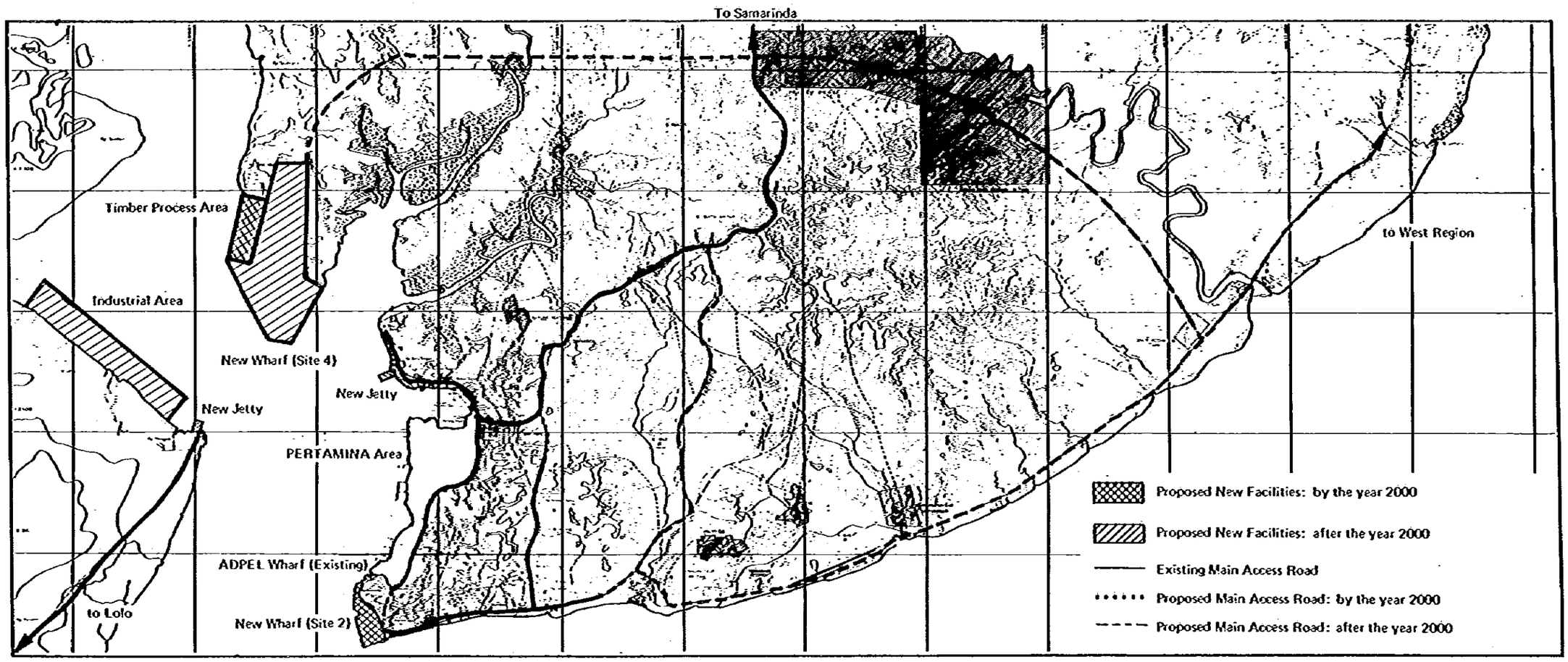
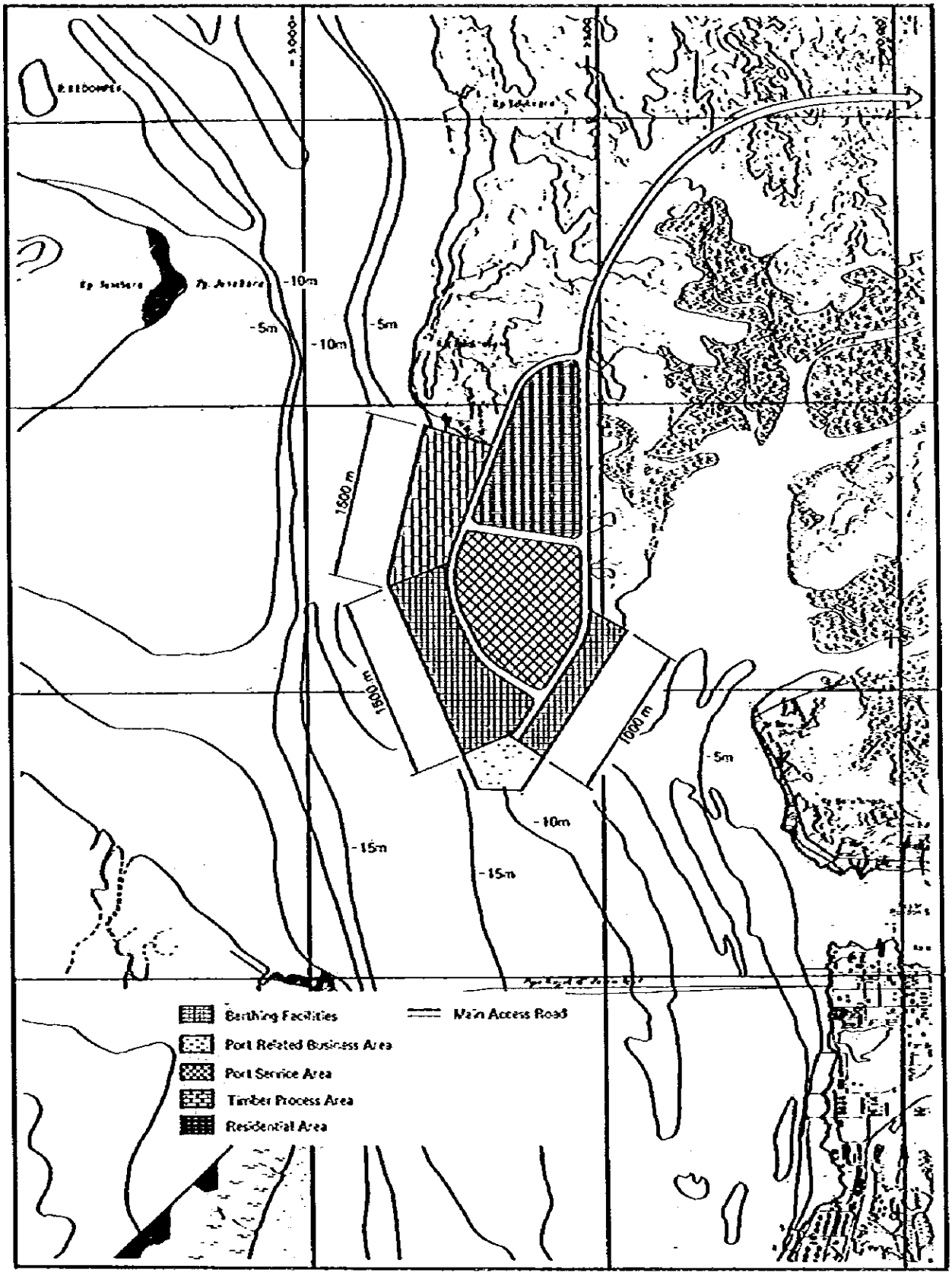


Fig. 7-13 Image Plan of Tg. Makasaar Area after 2000



Chapter 8
Short-Term Development Plan

CHAPTER 8
SHORT-TERM DEVELOPMENT PLAN

8-1 Scale of the Port

As mentioned in Chapter 7, the volume of cargo handled at ADPEL of Balikpapan in 1985 is estimated at 611 thousand tons (foreign trade:345 thousand tons, domestic trade:266 thousand tons). The cargo handling capacity at the wharf in 1985 is estimated, as given in Chapter 7, to be 900 t/m in foreign trade, 700 t/m for Interinsular vessels and 500 t/m (140 t/m at the jetty of Kampung Baru) for local vessels and sailing vessels.

The length of berth required is, as shown in Table 7-2, 353m for foreign trade and 266m for domestic trade by Interinsular vessels.

While the required area for transit sheds and open storage yards is as shown in Table 7-4.

The volume of traffic generated from the port, except Kampung Baru area, is estimated at 550 vehicles/hour and required terminal site area (excluding Kampung Baru areas) of the port is estimated at 10.6 to 17.7 ha.

> For required length of berth, see 7-1-1, for required area of transit shed and open storage yards, see 7-1-2 and for planned traffic volume, see 7-1-3.

8-2 Arrangement Plan of Port Facilities

The berths to be constructed in 1980 to 85 are two −9 m berths (165 m x 2 berths) for foreign trade and 50 m jetty (as length of the port facilities and over 50 m as length of the berth) of Kampung Baru for local vessels and sailing vessels as a local trade berth.

For handling and storage facilities of cargo, one transit sheds (6000 m^2) for foreign trade must be constructed and open storage yard of over 1600 m^2 must be secured for foreign trade. (Table 7-7) 6900m^2 must be secured for foreign trade. (Table 7-7)

Every facility except the jetty of Kampung Baru must be arranged as shown in Fig. 8-1, keeping in mind the long term program mentioned in Chapter 7.

8-2-1 Port Facilities Plan

(1) Mooring Facilities Plan

The length of foreign trade berth required in 1985 for Site 2 area is 353 m as shown in Table 7-2.

For this, as mentioned in 6-3, the largest size of general ocean going vessel in 1985 is expected to be 10,000 DWT. The berth required for 10,000 DWT vessel is generally for water depth of −9m and length of 165 m. When two −9m berths of 165 m are constructed in 1985, the length of foreign trade berth will be 165 m x 2 = 330 m or 23 m short of the required length. As it is uneconomical to construct three berths, only two berths will be constructed by 1985 and the shortage is to be covered by the improved efficiency of cargo handling work.

The required length of berth for local vessels and sailing vessels in Kampung Baru area in 1985 will be 571 m as shown in Table 7-2. For this, as shown in Fig. 7-1, if the existing head of the jetty is extended for 50 m (this is being planned by ADPEL), the length of berth (available length of jetty) will be 580 m. Therefore, it is decided to extend the top end of jetty at Kampung Baru for 50 m.

As regards the berth for Interinsular vessels, the required length in 1985 will be 266 m as shown in Table 7-2, and if the berth constructed in 1979 is added to the existing berth, it will be 271.6 m and there is no need for further extension in 1985. Accordingly the reef to be removed in 2000 need not be removed in 1985.

(Reference) Check of the Required Number of Berths in 1985 by Queuing Theory

o Foreign Trade Berths

The nuber of incoming ocean going vessels in 1985 is estimated at 390 (See Table 6-45; Including the Singapore route). The incoming vessels per day λ is

$\lambda = 390/365 = 1.07$ vessels/day.

The average number of days of berthing is assumed to be about 1.5 owing to improvement in the efficiency of cargo handling and various port procedures.

Thus, the reciprocal μ of the average number of days of berthing is

$\mu = 1/1.5 = 0.67$

If the average waiting time is assumed to be about 1,5 days, the average number of days in port W is

W = Average number of days of berthing + Average waiting time = 1.5 + 1.5 = 3.0 days.

Then, the average number of vessels in port L is

$L = W \times \lambda = 3.0 \times 1.07 = 3.21$

Assuming that the distribution of berthing time is Phase II Erlang distribution and that the usage rate $\rho = 0.6 \sim 0.8$, the number of berths S satisfying the value of L above is obtainable as

$S = \lambda/\rho \cdot \mu = 1.07/\{(0.6 \sim 0.8) \times 0.67\} = 1.99 \sim 2.66$

Thus, the required number of berths in 1985 is 2~3.

On the other hand, the required length of berths obtained in use of the throughput is 353m, as described above, and this value is somewhat exceeding the length of two berths. But, constructing 3 berths seems to involve a risk of excessive investment so that until 1985, construction of foreign trade berths will be limited 2 berths.

o Domestic Trade Berths (Interinsular Berths)

The number of incoming interinsular vessels in 1985 is estimated at 620 (See Table 6-45). The incoming vessels per day λ is

$\lambda = 620/365 = 1.70$ vessels/day.

Assuming the average number of days of berthing to be 1.5 days,

$\mu = 1/1.5 = 0.67$.

If the average waiting time is assumed to be about 1.5 days, the average number of days in port W is

$W = 1.5 + 1.5 = 3.0$.

Then, the average number of vessels in port L is

$L = W \times \lambda = 3.0 \times 1.70 = 5.1$.

Assuming that the distribution of berthing time is Phase II Erlang distribution and that the usage rate $\rho = 0.6 \sim 0.8$, the number of berths S satisfying the value of L above is obtainable as

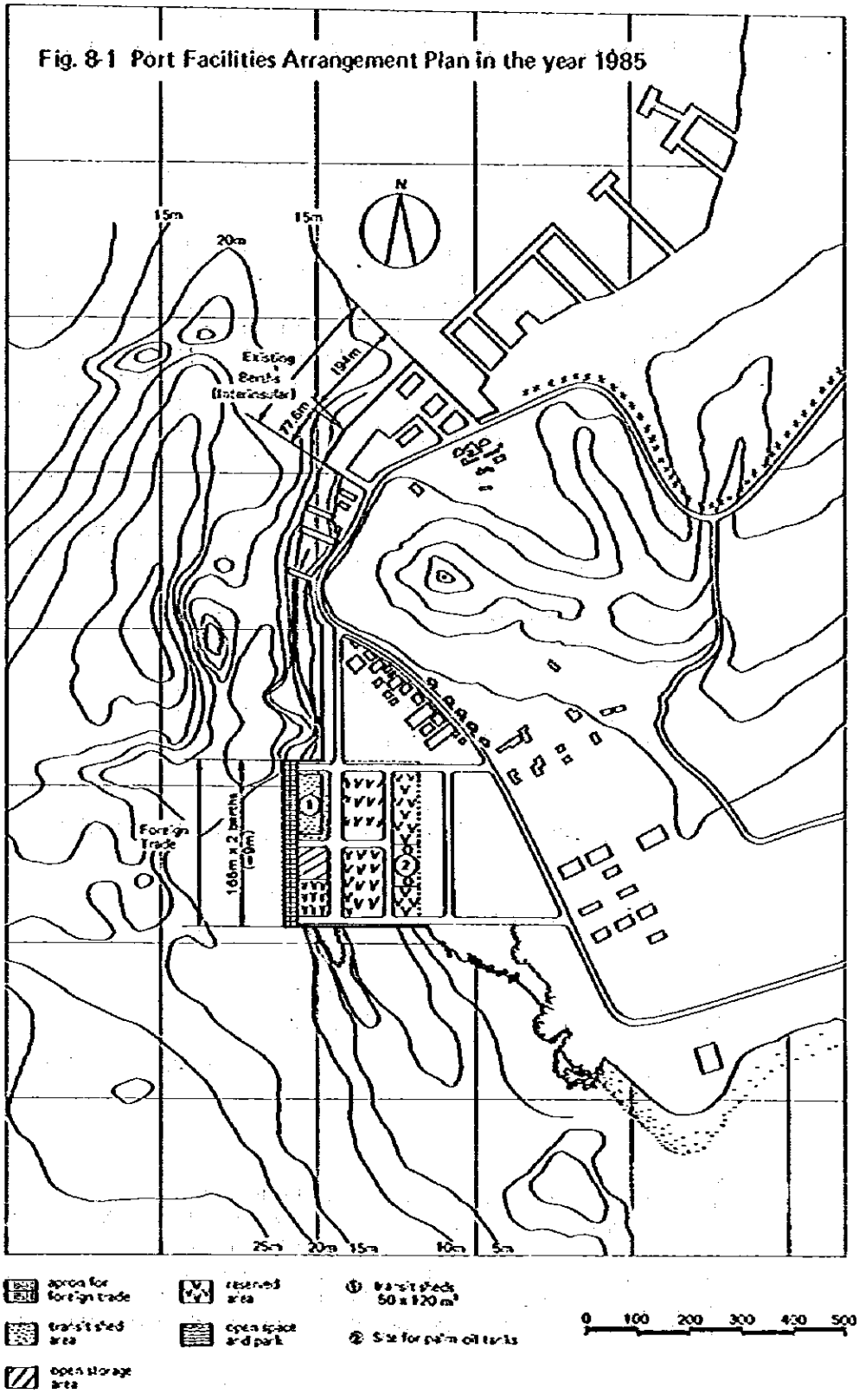
$S = \lambda/\rho \cdot \mu = 1.70/\{(0.6 \sim 0.8) \times 0.67\} = 3.17 \sim 4.22$.

Thus, the required number of berths in 1985 is 4~5.

On the other hand, the required length of berths obtained in use of the throughput is 266m, as described in the foregoing. Here, the objective vessels are of the class of 600 DWT average so that the required berth length per vessel is about 60m. Then, the extension of 266m corresponds to 4~5 berths.

Consequently, no construction of interinsular berth is required for the period of 1980~1985, as stated in the foregoing (as the length of the available berths is as great as 271.6m if the length of 77.6m constructed in 1979 in added).

Fig. 8-1 Port Facilities Arrangement Plan in the year 1985



(2) Plan for Handling and Storage Facilities

Transit sheds as cargo handling and open storage yard as storage facility will be arranged as shown in Fig. 8-1. The size of the transit sheds is 120 m x 50 m for foreign trade cargo.

(3) Plan for various Facilities for Port Administration

In 1985, the center of the public port will somewhat shift to the south but the present port administration office may still be used.

A ferry service to Penajam is considered to be not yet in operation at this stage.

(4) Road Plan

As the volume of traffic is not very large in 1985, roads other than in the port area need not be provided.

(5) Water Supply, Oil Supply and Power Supply Plans

Water is currently being supplied from PERTAMINA but as shortage is expected in the 1985 plan, water wells will be dug to secure adequate supply of water. In order to increase water pressure, overhead water tanks will be provided. Two pipelines will be connected to the water tanks. One pipeline will feed water to the three water tanks owned by ADPEL and another will feed water to the newly installed foreign trade berth. The piping from the ADPEL water tanks to the existing public berth is already installed but as it is not presently used, effective use shall be considered. For fire fighting facilities on land, fire hydrants are installed at the wharf using water supply piping. For fire fighting on the sea, fire fighting equipment installed at the newly procured tug boat will be used.

As regards oil supply facilities, as PERTAMINA controls fuel oil, ADPEL does not own such facilities.

As regards power supply, power is supplied from National Power Corporation (PLN) in Balikpapan City to every new facility and lighting equipment through the substation built in the Port of Balikpapan.

For emergency power supply, an independent power plant is considered to secure minimum illumination for safety.

(6) Cargo Handling Equipment and Service Vessel

Table 8-1 shows new requirements of cargo handling equipment and service vessels by 1985. Please refer to Chapter 10 Administration and Management for the method of calculating the number of the equipment and vessels.

Table 8-1 Newly required cargo handling equipment and service vessels by 1985

Classification		Number of new requirement	Total number operating
Cargo handling equipment	Forklift	3	8
Service vessel	Tug boat	2	5
	Pilot boat	1	4

Note) Total number operating – Newly required number = Present number

8-2-2 Land Use Plan

The land use plan in the port areas is considered as follows.

As shown in Fig. 8-1, transit sheds and open storage yards and other facilities related directly to port work are placed on the first line and second line is reserved for the future demand. And on the third line and thereafter is placed a site for palm oil tank, etc.

As mentioned in 7-2-3, two 2500 kl-tanks for palm oil will be required in 1985.

At this point, there will be no change in the use of land in the outside of the port area.

Chapter 9
Construction Program

CHAPTER 9
CONSTRUCTION PROGRAM

9-1 Fundamental Conditions for Design, Construction and Cost Estimate.

In this Chapter the fundamental conditions will be described for design, construction and cost estimate for plan of a construction program of the port facilities upon the short term development plan in Chapter 8.

The design conditions for the foreign trade pier which is the major structure of the port facilities are as shown in Table 9-1.

Table 9-1 Design Conditions for Foreign Trade Pier

Items	Design Conditions for Foreign Trade Pier
1. Objective vessel	General Cargo Vessel of 10,000 DWT or 15,000 DWT with 0.10~0.15m/sec of approaching velocity
2. Tidal Level	HWL: +2.83m
3. Top Elevation of Pier	+4.25m
4. Water Depth in front of Pier	-9.0m for 10,000 DWT Vessel, -10.0m for 15,000 DWT Vessel
5. Load to be supported	Uniform load: 3.0t/m² (usual), 1.0t/m² (earthquake) Live load: Forklift 6t, Truck crane 15t
6. Condition of foundation	Bearing layer with N≥50 is at −20.0m Seismic Coefficient Kh = 0.1
7. Allowable stress of material	Reinforced concrete σca_1 = 80kg/cm² Plain concrete σca_2 = 53kg/cm² Steel σsa = 1,400kg/cm² Corrosion rate = 0.025~0.15 mm/year
8. Safty factors	Circular failure 1.3, Sliding 1.2, Overturning 1.2, Bearing of Pile 2.5, Pulling of Pile 3.0
9. Durable years	50 years

The conditions of construction/cost estimate for the port terminal are shown in Table 9-2.

Table 9-2 Conditions of Construction/Cost Estimate for Port Terminal

Items	Construction Conditions for Port Terminal
1. Natual condition	Sea phenomena is not bad.
2. Labor	Skilled labors will be provided from other places.
3. Equipment	Big working crafts are provided from Surabaya, Tg. Priok or Singapore (Pile driver, Suction pump, Floating crane)
4. Material	Timber, Sand and Stone at Balikpapan, Other materials from other places
5. Reclamation	Sand from sea with a suction pump.
6. Schedule	Engineering service 11 months, Construction 3 years and 3 months.
Items	**Conditions for cost Estimate of Construction**
1. Exchange rate	1 US dollar = 625 Rupiah.
2. Price	is expressed in 1979's one.
3. Import due	is not considered for imported material/equipment.
4. Sales tax	is considered for local currency portion.
5. Contingency	is 15% for physical unknown factors and 15% for price respectively.

9-1-1 Design Conditions

The port facilities comprise various structures, and it is required to clearly set forth the design conditions to be used in determining their structural cross-sections. To implement the design of the port facilities in accordance with the design standards of Indonesia, every effort was exerted with cooperation of the counterparts of the Sea Communication Directorate, but there were some matters we were unable to set forth clearly. Thus, here, the principal conditions to be used for comparative design of the structural form of the wharf will be described.

(1) Objective vessels.

Foreign trade pier;

10,000 DWT or 15,000 DWT

As stated in Chapter 8, the largest of the objective ships of the foreign trade berth in the short term development project with 1985 as the target year is 10,000 DWT.

For the 10,000 DWT ships, the design water depth is −9.0m, and for the 15,000 DWT ships, it is −10.0m. If the −9m pier and −10m pier are not much different in the construction cost, the pier is preferably designed and executed for the −10m depth where a −9m wharf will suffice according to the plan, if increasing size of ship in the future is taken into consideration.

Thus, in the design, both 10,000 DWT and 15,000 DWT were considered as the objective ships.

Approaching velocity V = 0.10~0.15m/sec.

(2) Tidal levels.

HWL : +2.83m

LWL : ±0.00m

(3) Top elevation of wharf;

+4.25m (When the tidal range is less than 3m, the top elevation of wharf is usually 1.0m~2.0m over HWL)

(4) Design water depth in front of wahrf,

−9.0m for 10,000 DWT Vessels, −10.0m for 15,000 DWT Vessels

(5) Design seismic coefficient.

Horizontal seismic coefficient Kh = 0.10.

(Presently, in the port structures, no vertical seismic intensity is taken into consideration.)

(6) Design loads.

Uniform load: $q = 3.0t/m^2$ as usual

$q' = 1.0t/m^2$ at time of earthquake

Live loads: 6t for loading capacity of Forklift

15t for lifting capacity of Truck crane

(7) Soil conditions

Reference should be made to "3-3 Soil and Earthquake Conditions of Balikpapam". The soil conditions used in design and calculation are as follows.

Table 9-3 Soil Condition.

Soil	Layer Thickness	N Value	Angle of Internal Friction	Remarks
Sandy soil	h = 3.00m	N = 0~5	$\phi = 25°$	Surface layer
Sandy soil	h = 7.00m	N = 5~20	$\phi = 30°$	Intermediate layer
Sandy soil	–	N≥50	$\phi = 30°$	Bearing layer

(8) Allowable stress intensities

Concrete: σ_{ca_1} = 80kg/cm² (for reinforced concrete) (allowable compressive stress intensity).

σ_{ca_2} = 53kg/cm² (for plain concrete) (allowable compressive stress intensity)

Reinforcing bar:

σ_{sa} = 1,400kg/cm² (allowable tensile stress intensity)

Steel: σ_{sa} = 1,400kg/cm² (allowable tensile stress intensity)

Under an unusual condition, 50% increase of the foregoing values respectively.

(9) Safety factors.

Table 9-4 Safety Factors.

Items	Safety Factors	
	Usual	Unusual
Circular failure	1.3	1.1
Sliding	1.2	1.1
Overturning	1.2	1.1
Bearing of Pile	2.5	2.0
Pulling of Pile	3.0	2.5

(10) Durable years.

Durability of the wharf is taken as 50 years.

(11) Corrosion of steel

In Japan, corrosion of steel materials used in ports and harbors is assumed to proceed at rates specified in the table 9-5. In the ports of Indonesia located in the tropical area, the rate of corrosion may vary, but in this design, the values shown in the table are used. It should be noted that the values represent those on one side of the steel.

Table 9-5 Corrosion Rates

Corrosive Environment	Corrosion Rates (mm/yr)
In sea water:	
Above HWL	0.15
Portion between HWL and sea bottom	0.10
Portion in bed mud layer	0.025
In soil:	
Above residual water level	0.025
Below residual water level	0.015

Steel pipe pile is protected from corrosion by electrolytic protection for the first 20 years of the durability of 50 years of the wharf and by increasing the material thickness for the remaining 30 years in this design. Accordingly, thickness allowance of steel pipe pile against corrosion is calculated by using the above Table 9-5 as follows.

Portion between HWL and sea bottom t_1=0.10mm/yr x 30 yrs=3mm

Portion in bed mud layer t_2 = 0.025mm/yr x 30 yrs = 1mm

9-1-2 Facility Work and Estimate Conditions

The Port of Balikpapan is located in the prominent city in East Kalimantan. But, unlike the Port of Tg. Priok or Surabaya in the Java Island, it has various handicaps in the port construction work. Therefore, in considering the workmethod, its special conditions must be fully taken into account.

(1) Natural conditions

In this construction program, the works at sea by means of construction craft constitute a greater part of the construction so that the sea condition is a critical problem. While there are

no reliable data of observation of the waves, the sea condition is considered to be good throughout the year according to the presumption from the wind data. However, in wet season, the work efficiency may decrease, and this should be taken into account in considering the schedule of construction works.

(2) Capacity of Construction

The contractor has to be introduced from the outside in that there is no contractor having a capacity enough to carry out the construction project at the site and in its peripheral area. The construction requires many skilled laborers temporarily, but they are scarcely recruited from the site and the peripheral area so that they have also to be introduced from the outisde.

(3) Construction equipment

Large construction craft (such as pile driving barge, pump dredger and floating crane) are not available at the site. They must be brought from Surabaya, Tg. Priok or Singapore. The cost of bringing the construction craft constitutes an significant proportion in the construction cost. Thus, it was planned in this construction program to reduce the number of large construction craft as far as possible. Construction equipment (such as bulldozer, power shovel and mobile crane) are for the greater part procurable at the site, but some has to be introduced from the Java Island or any other areas.

(4) Construction materials

Construction materials that are available at the site and in the peripheral area are only timber, sand and stones*. Construction standard products, cement and steels that are used in a great quantity respectively have to be introduced from the other areas. Consequently, the construction cost is relatively higher than that in the Java Island or other places.

*Stones have become to be available at Balikpapan, because a quarry area has been recently developed in the neighbourhood of Balikpapan.

(5) Construction base.

For introduction of the materials from the sea, the existing public wharf is usable. There is an open storage in the back of the public wharf, but the space usable as a temporary yard is limited. Consequently, we have to take a method of providing a temporary yard as soon as possible in the area of the construction work.

(6) Method of reclamation.

For reclamation, use of pit soil and that of sea sand are conceivable. The volume of soil for reclamation is 905,000m^3. In the vicinity of the construction site, there is no adequate mountain found which is adapted to supply a large amount of pit soil so that the reclamation would be made in use of sea sand by means of pump dredger.

(7) Construction schedule.

According to the construction program, it is planned to start the soil investigation, the hydrographic survey and the engineering study in January 1981. The actual construction work will be initiated in October 1981 and be completed in December 1984. The construction period is 4 years. From January 1985, the whole port facilities can be used effectively to cope with the cargo volume of 1985.

(8) Conditions of cost estimate.

Fundamental conditions are as set forth clearly in the facility work and estimate conditions stated above. Here, the other conditions are considered.

The exchange rate is 1 US dollar = 625 Rp.

The prices are expressed by those in 1979.

Customs duties for the imported construction materials and equipment and taxes (for the foreign currency in the cost estimate) are not included.

For the local currency, a sales tax of 5 percent is considered.

The physical contingency is considered at 15 percent but not for the soil investigation and hydrographic survey and the engineering study and supervision.

The price contingency is considered at 15 percent.

9-2 Comparative Design and Other Facilities.

For the foreign trade pier, five alternative plans alternative plans (A, B, C, D and E) were compared with one another.

Alternative Plan A Steel pipe pile open type pier (design water depth: −9.0m) (Figs. 9-1 (1) and (2)).

Alternative Plan B Steel pipe pile open type pier (design water depth: −10.0m) (Figs. 9−2 (1) and (2)).

Alternative Plan C Concrete pile open type pier (design water depth: −10.0m) (Figs. 9-3 (1) and (2)).

Alternative Plan D Pipe-type sheet pile pier (design water depth: −10.0m) (Figs. 9-5 (1) and (2)).

Alternative Plan E Concrete caisson wharf (design water depth: −10.0m) (Figs. 9-5 (1) and (2)).

As the result of comparison of the economy and workability, it is decided to employ alternative plan A (Steel pipe pile open type pier (design water depth: −9.0m)).

Table 9-6 Comparison of economy (Construction Cost).

Item \ Type	Alternative plan A Steel pipe pile open type pier (design water depth = −9.0m)	Alternative plan B Steel pipe pile open type pier (design water depth = −10.0	Alternative plan C Concrete pile open type pier (design water depth = −10.0m)	Alternative plan D pipe-type sheet pile pier (design water depth = −10.0m)	Alternative plan E Concrete caisson wharf (design water depth = −10.0m)
Construction cost, US$/m	14,400	15,500	16,250	17,860	17,440
Mobilization/ Demobilization US$/m	170	170	170	170	780 (190)
Total, US$/m	14,570	15,670	16,420	18,030	18,220 (17,630)
Proportion with Alternative plan A as 1.0	1.00	1.08	1.13	1.24	1.25 (1.21)

Note (1) Parenthesized figures for Alternative plan D represent the costs in the case of a floating dock being brought from Surabaya.

(2) The cost of bringing construction crafts is counted once (round trip) in the work of 2 berths (330m).

Table 9-7 Comparison of workability

Item \ Type	Alternative plan A and Alternative plan B, steel pipe pile open type pier	Alternative plan C concrete pile open type pier	Alternative plan D pipe-type sheet pile pier	Alternative plan D concrete caisson wharf
Large construction craft	Pile driving barge (with D-40 hammer)	Pile driving barge (with D-40 hammer)	Pile driving barge (with D-40 hammer)	Floating dock (1300 t)
Bringing of large construction craft	From Surabaya	From Surabaya	From Surabaya	From Japan (From Surabaya)
Workability at sea	Very easy ◎	Easy ○	Very easy ◎	Not so easy △
Construction control	Very easy ◎	Easy ○	Very easy ◎	Not so easy △
Workload	Small ◎	Relatively small ○	Small ◎	Much △
Construction speed	Very fast ◎	Fast ○	Very fast ◎	Not so fast △
Adaptability to change in ground	Good in adaptability ◎	Adaptable ○	Good in adaptability ◎	Adaptable ○
Requirement of corrosion prevention	Required △	Not required ◎	Required △	Not required ◎
Easiness of material procurement	Steel pipe piles must be imported △	Accommodated with domestic products ◎	Pipe-type sheet piles must be imported △	Accommodated with domestic products ◎

Note (1) Where the bearing layer is changing in a complex manner, pile jointing is enabled in the cases of Alternative plans A, B and D but is difficult in the case of Alternative plan C.

(2) In the cases of Alternative plan A, B or D, it is practicable to penetrate a steel pipe pile or pipe-type sheet pile for about 0.5m–1.0m into the bearing layer of N value at about 50, but in the case of Alternative plan C, it is difficult.

(3) In the case of a ground condition precluding penetration of the pile of Alternative plan A, B, C or D, a gravity wharf such as Alternative plan E must be employed.

Fig. 9-1 (1) Foreign Trade Pier (Alternative Plan—A) Standard Cross Section

Scale 1:200

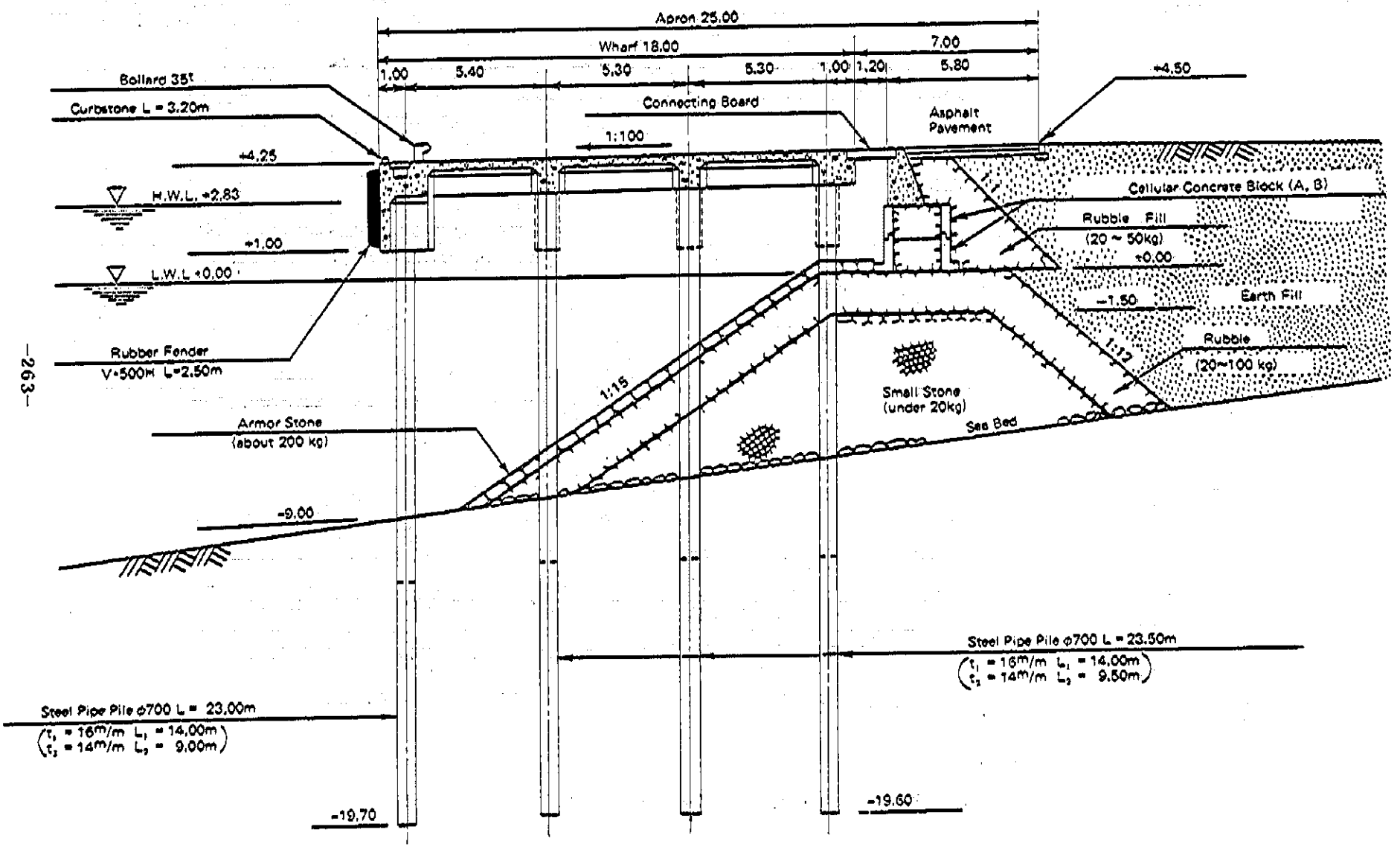
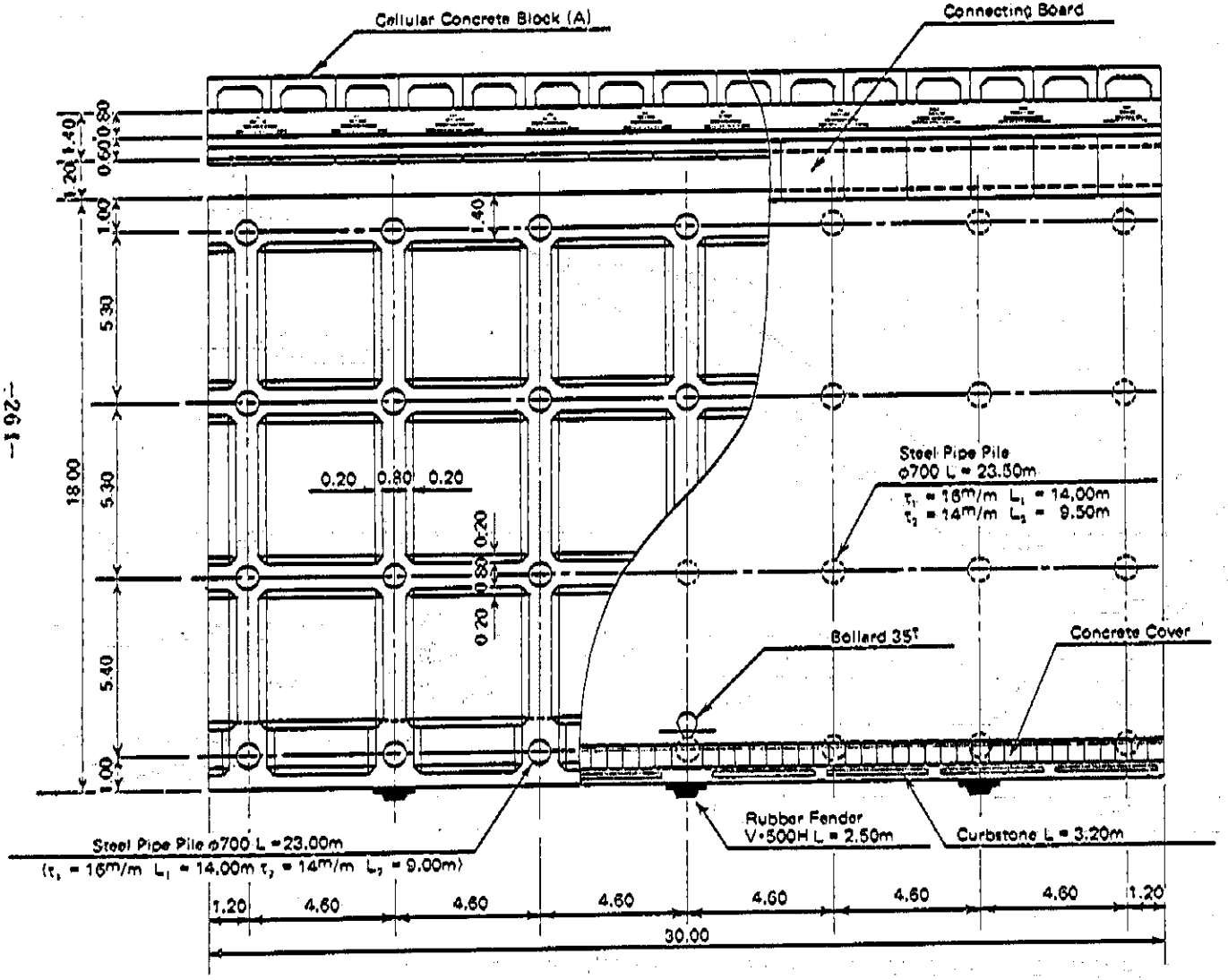
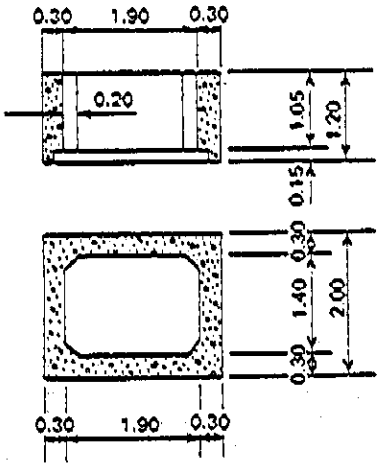


Fig. 9-1 (2) Foreign Trade Pier (Alternative Plan—A) Plan

Scale 1:200



CELLULAR CONCRETE BLOCK(A)
Scale 1:100



CELLULAR CONCRETE BLOCK(B)
Scale 1:100

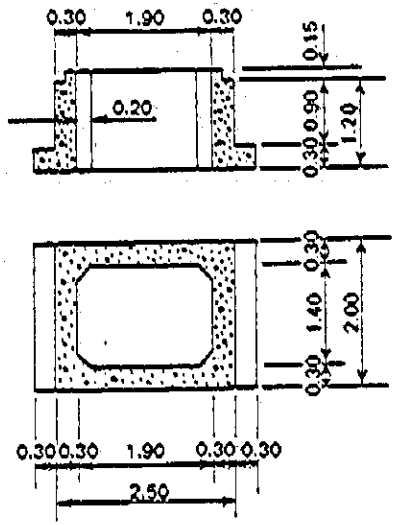


Fig. 9-2 (1) Foreign Trade Pier (Alternative Plan-B) Standard Cross Section

Scale 1:200

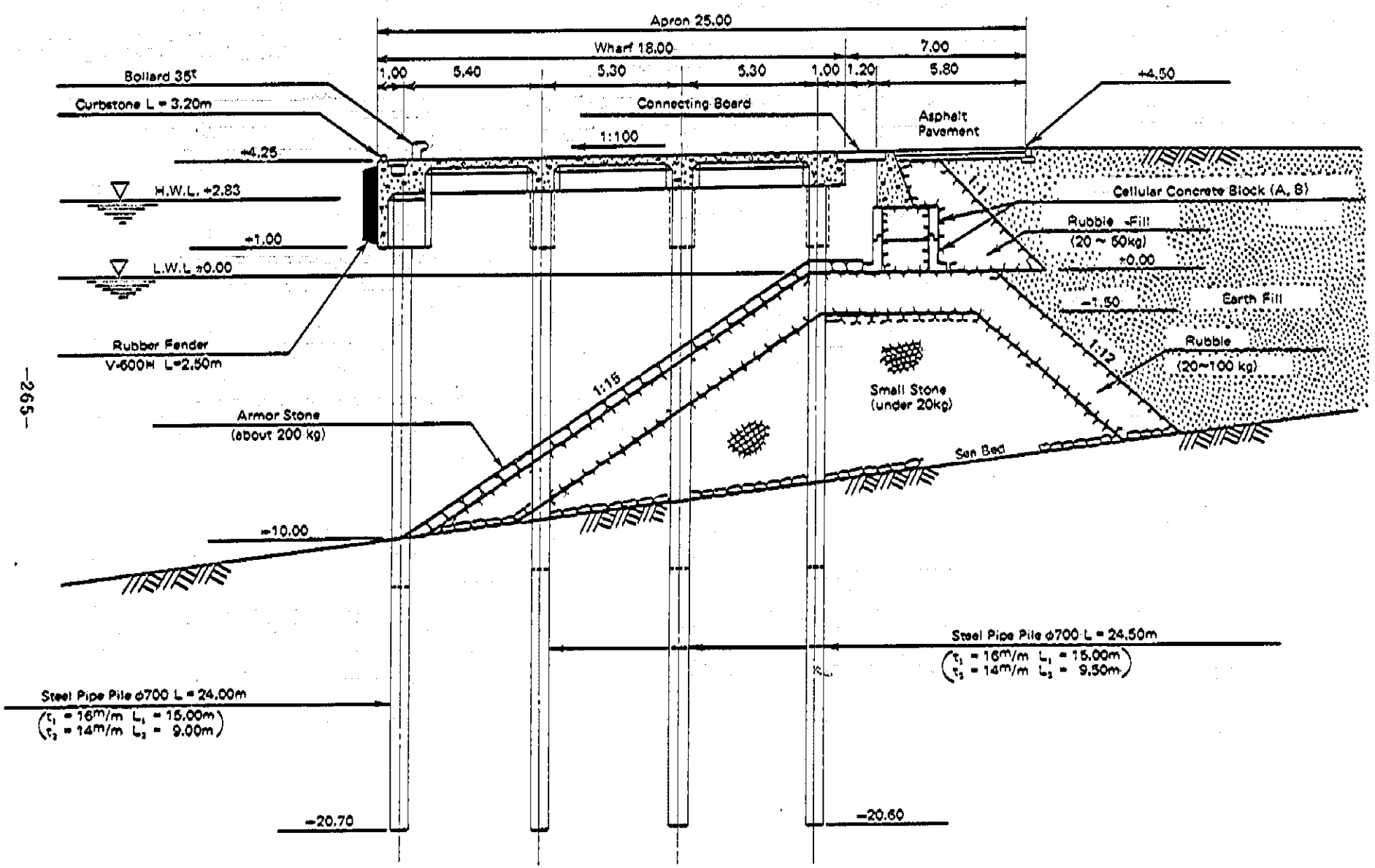
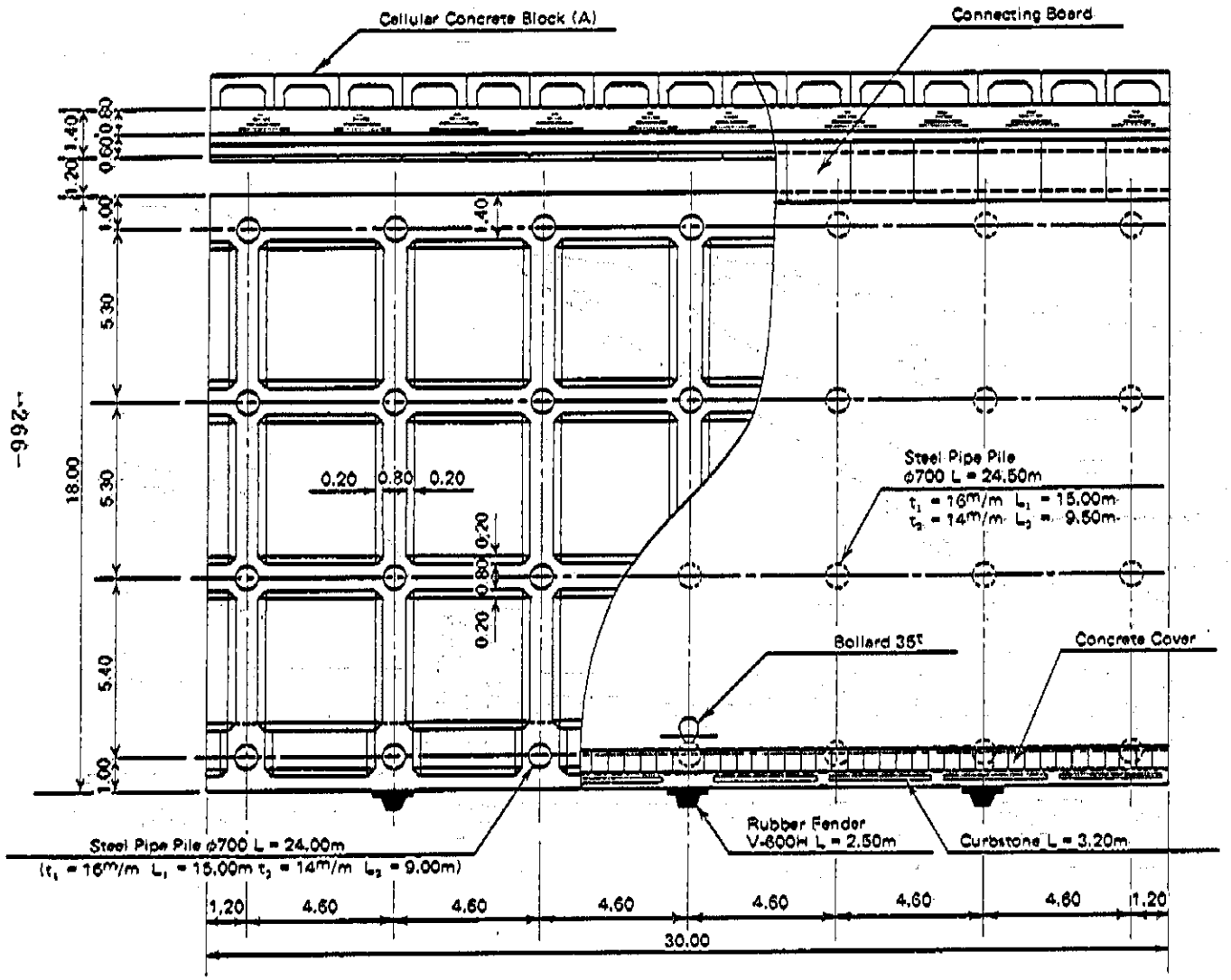
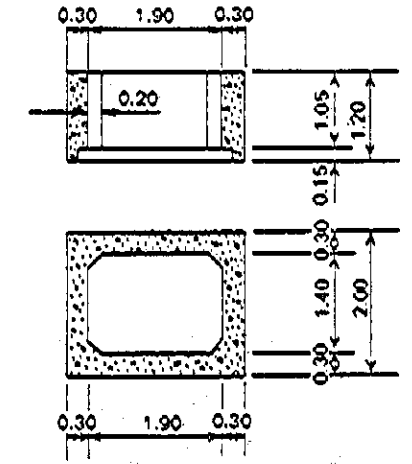


Fig. 9-2 (2) Foreign Trade (Alternative Plan—B) Plan

Scale 1:200



CELLULAR CONCRETE BLOCK(A)
Scale 1:100



CELLULAR CONCRETE BLOCK(B)
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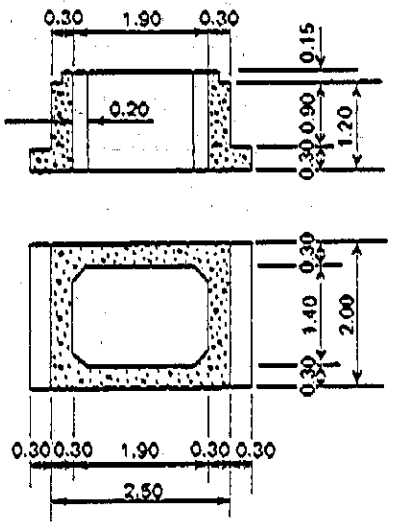


Fig. 9-3 (1) Foreign Trade Pier (Alternative Plan—C) Standard Cross Section

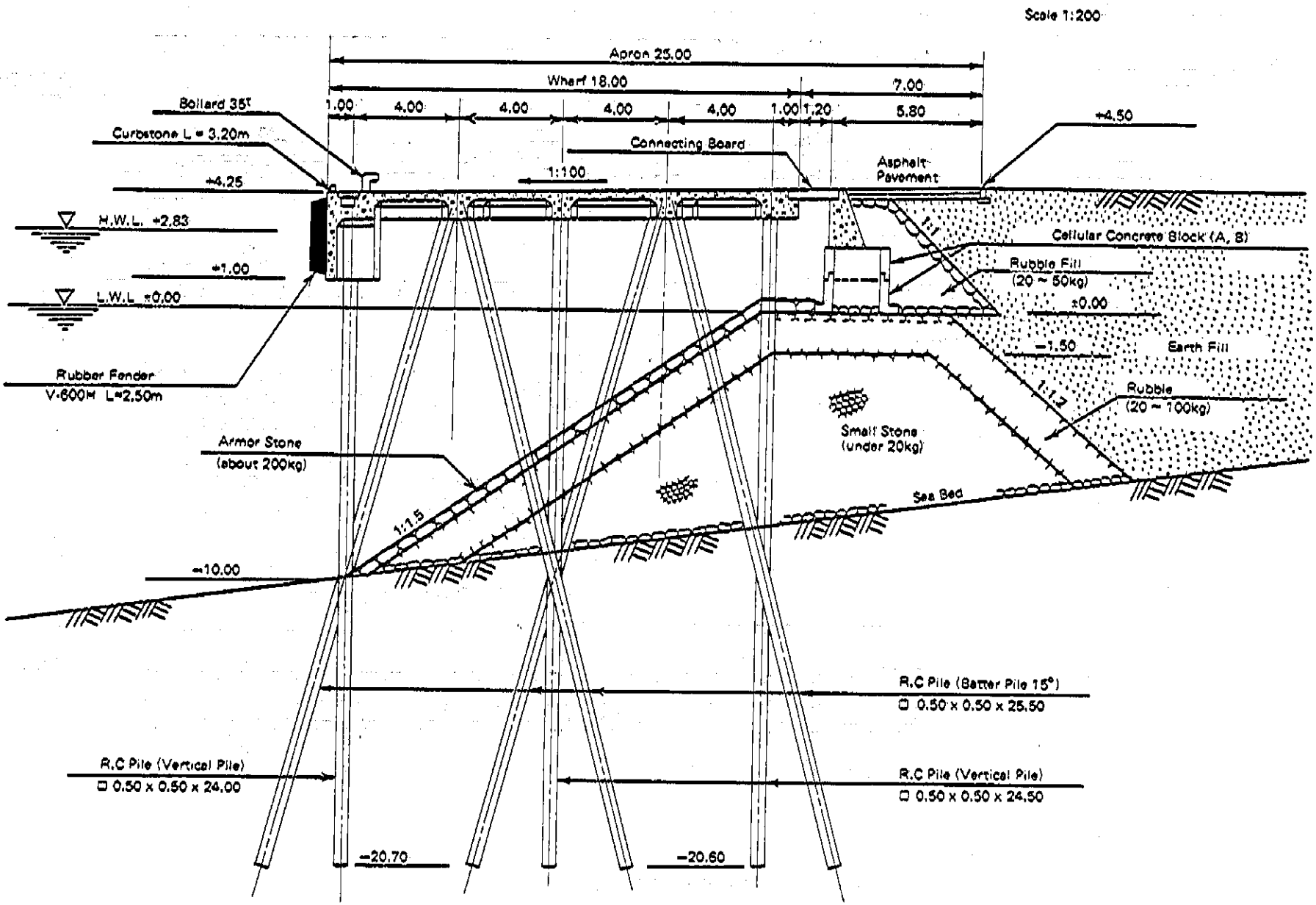
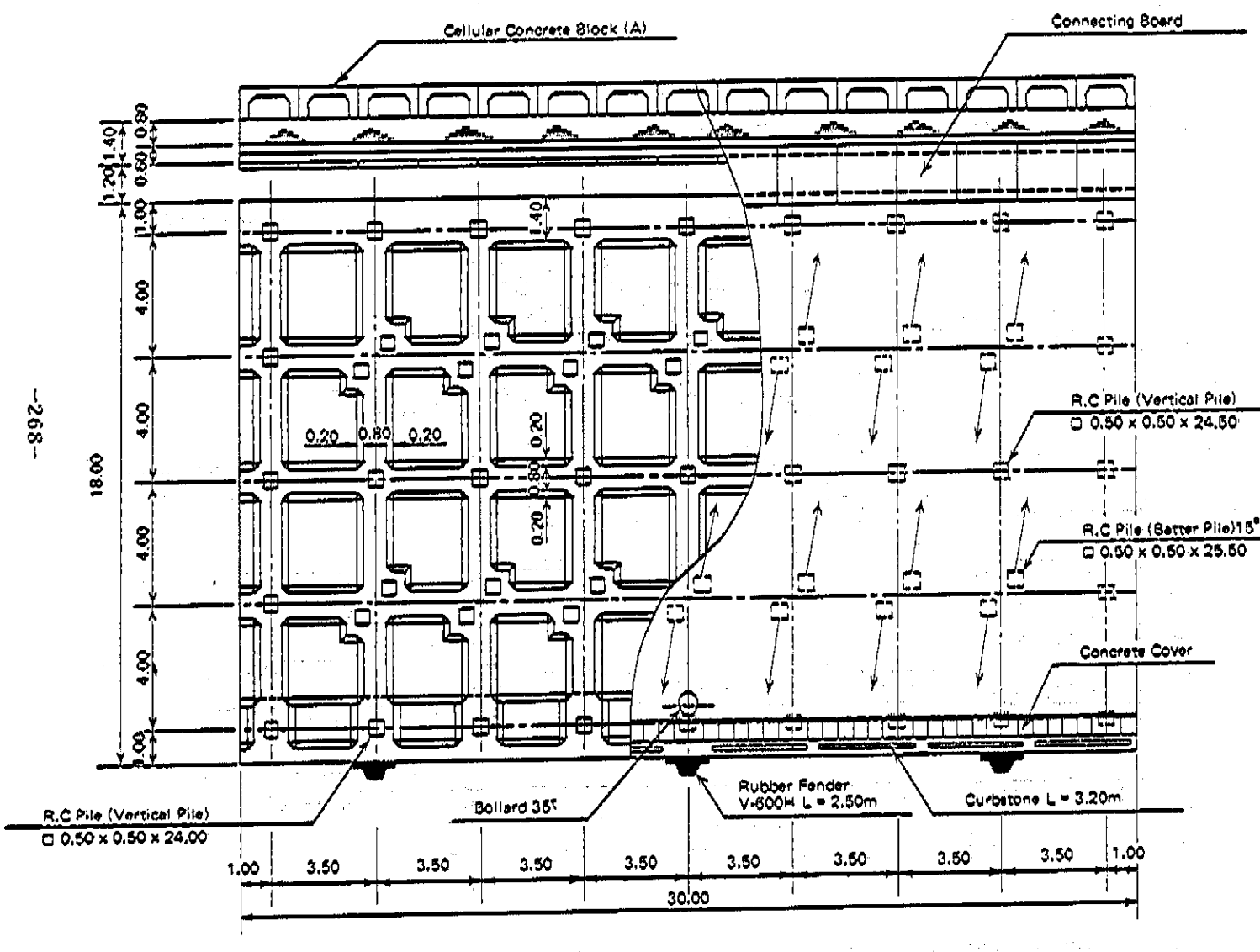


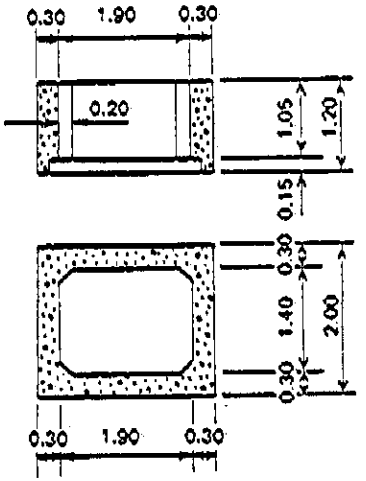
Fig. 9-3 (2) Foreign Trade Pier (Alternative Plan—C) Plan

Scale 1:200



CELLULAR CONCRETE BLOCK (A)

Scale 1:100



CELLULAR CONCRETE BLOCK(B)

Scale 1:100

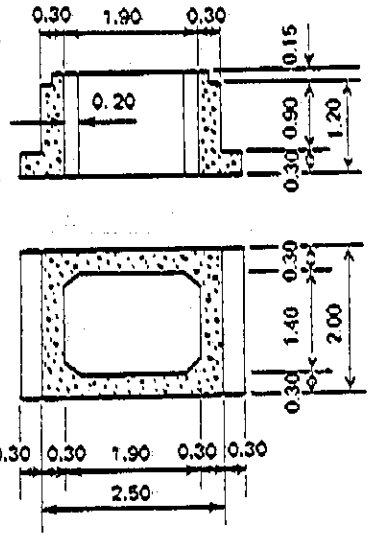


Fig. 9-4 (1) Foreign Trade Pier (Alternative Plan-D) Standard Cross Section

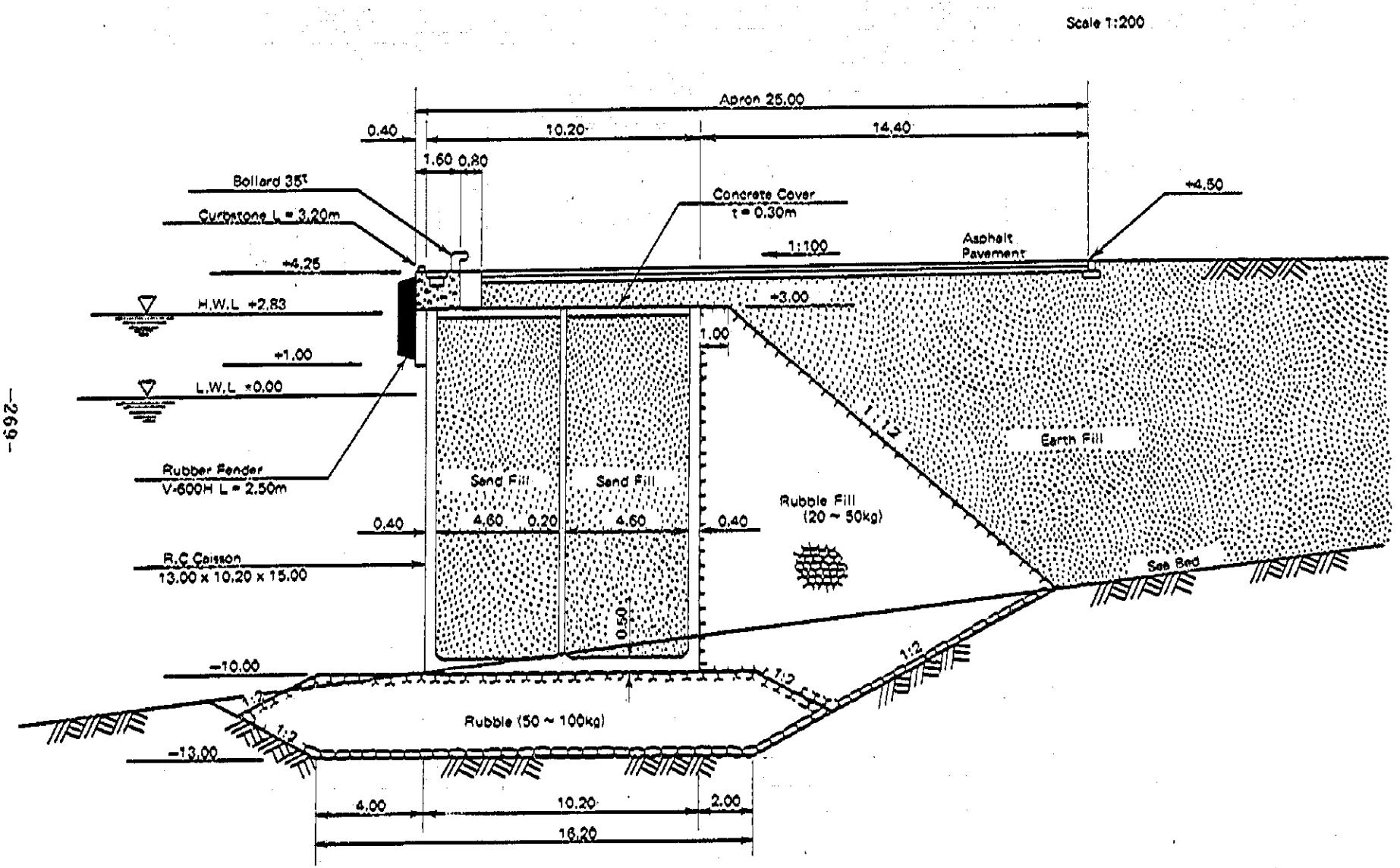


Fig. 9-4 (2) Foreign Trade Pier (Alternative Plan–D) Plan

Scale 1:200

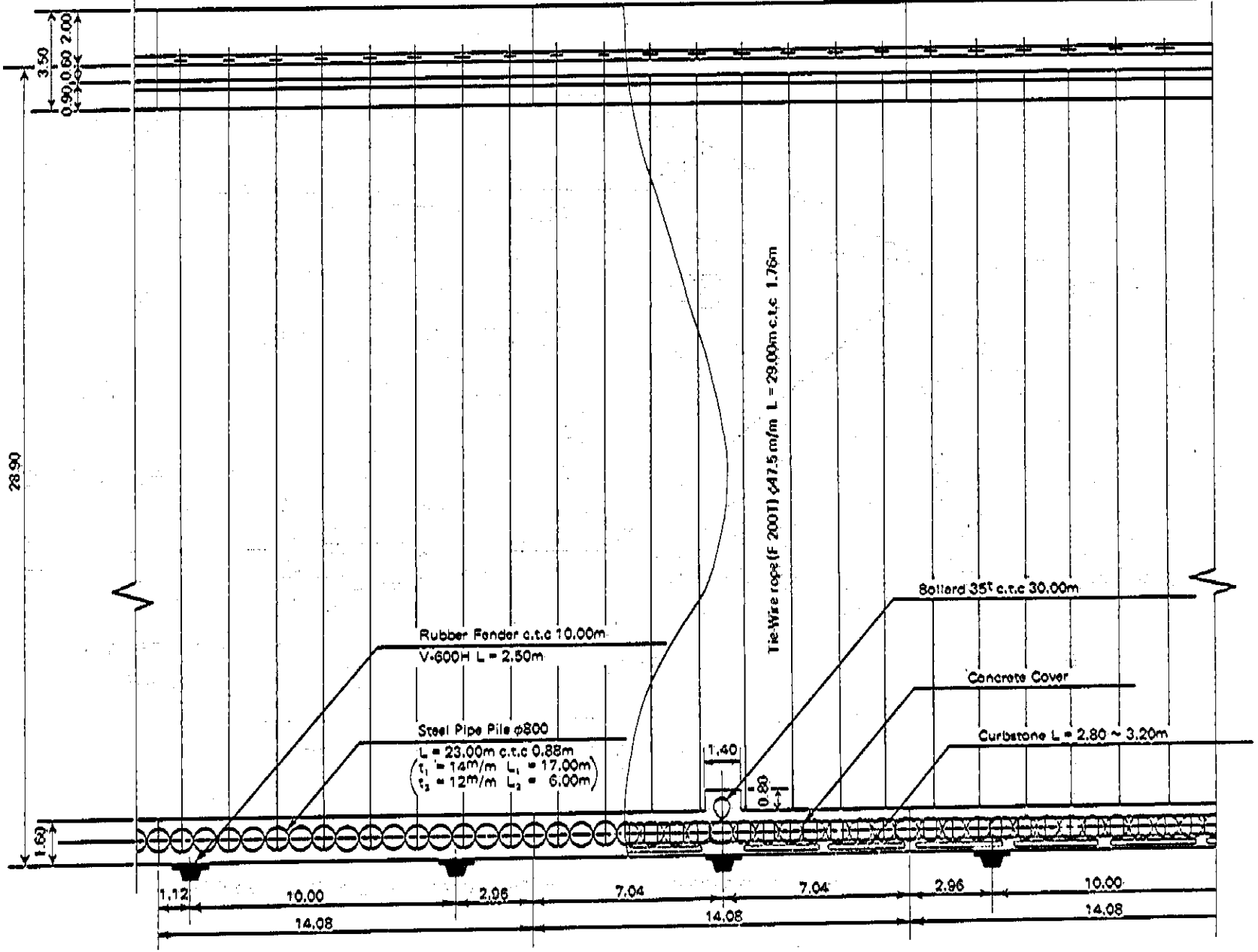


Fig. 9-5 (1) Foreign Trade wharf (Alternative Plan—E) Standard Cross Section

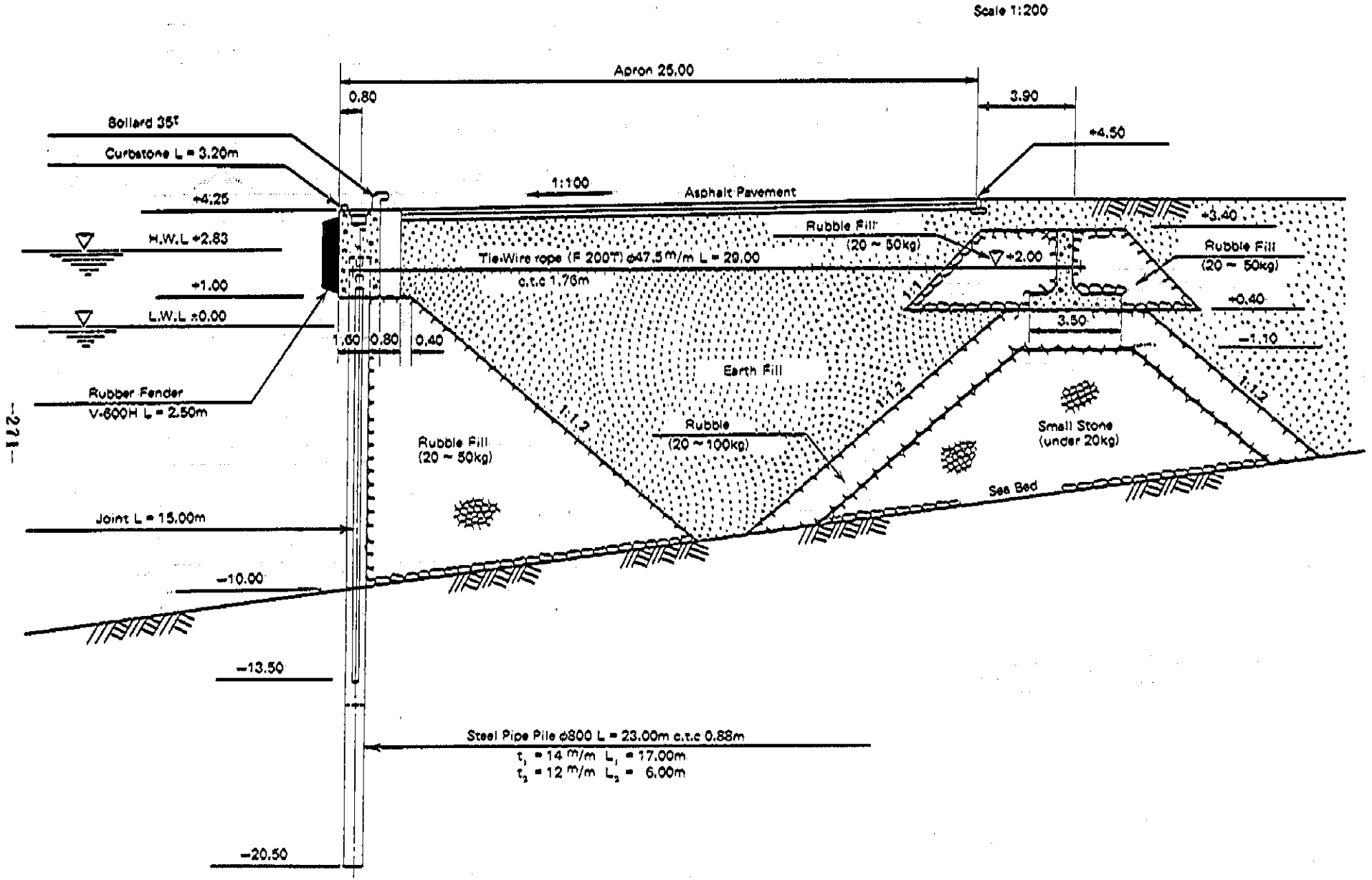
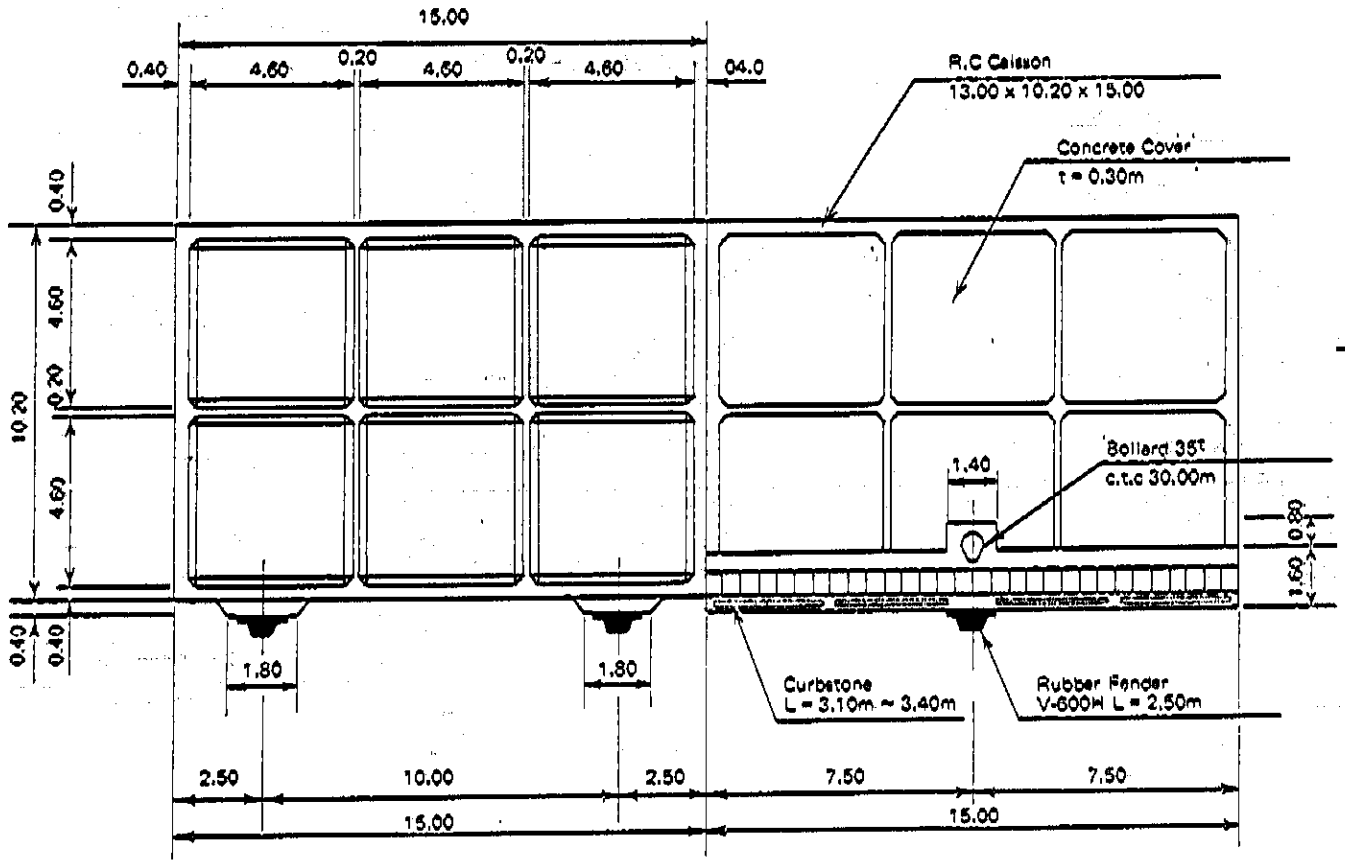


Fig. 9-5 (2) Foreign Trade wharf (Alternative Plan—E) Plan

Scale 1:200



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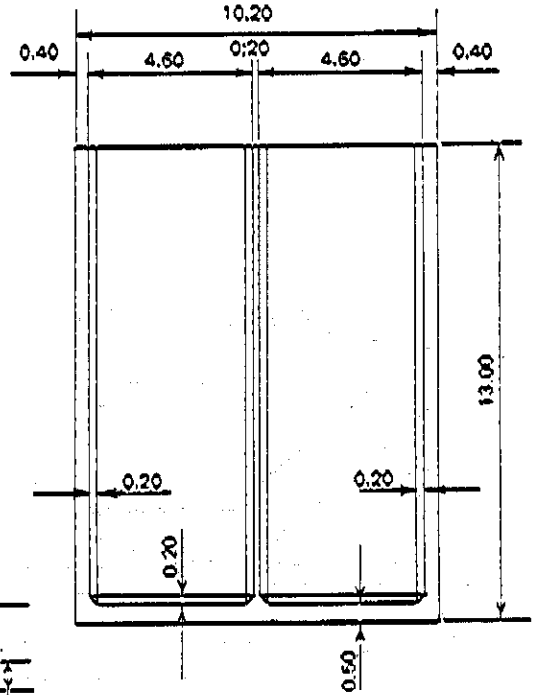


9-2-1 Alternative Plan A (Steel Pipe Pile Open Type Pier ..... Design Water Depth −9.0m) and Alternative Plan B (Steel Pipe Pile Open Type Pier ..... Design Water Depth −10.0m)

(1) Pile driving of steel pipe piles is made by a pile driving barge (a diesel pile hammber (D-40)). It is made at a rate of 4 piles/day.

(2) A steel pipe pile is lighter in weight than a reinforced concrete pile and is handled with ease at the time of pile driving. It has a great bending strength and has a large resistance for lateral force but, at the same time, has a great shortcoming of having corrosion produced. Therefore, a thorough corrosion prevention must be taken.

(3) A pipe driving barge is brought from Surabaya.

9-2-2 Alternative Plan C (Concrete Pipe Open Type Pier ..... Design Water Depth −10.0m)

(1) Pile driving of reinforced concrete piles is made by a pile driving barge (a diesel pile hammer (D-40)). It is made at a rate of 4 piles/day for vertical piles and 3 piles/day for batter piles.

(2) A reinforced concrete pile is subject to damage to the pile body by careless working at the time of pile suspension and pile driving.

(3) The structure of the bulkhead is the same with that of Alternative plan A or Alternative plan B.

(4) A pile driving barge is brought from Surabaya.

9-2-3 Alternative Plan D (Pipe-type Sheet Pile Pier ..... Design Water Depth −10.0m)

(1) Pile driving of pipe-type sheet piles is made by a pile driving barge (a diesel) pile hammer (D-40)). It is made at a rate of 4 piles/day.

(2) The anchorage is an inverted T-type of reinforced concrete mixed and placed in site.

(3) Tie-Wire rope, which is a steel cable for tie, is worked between pipe-type sheet piles and anchorages.

(4) For the first 20 years of the durability of 50 years, electrolytic protection is applied, for the remaining 30 years, a thickness of 1mm−3mm is provided as an allowance against corrosion.

(5) A pile driving barge is brought from Surabaya.

9-2-4 Alternative Plan E (Concrete Caisson Wharf ..... Design Water Depth −10.0m)

(1) Concrete caissons (width 10.20m x height 13.00m x length 15.00m) are installed to build a gravity wharf. The weight of a caisson is about 1,000t.

(2) Production of the concrete caissons is made on a floating dock (1300t type). If concrete caissons are produced one by one on a floating dock, the construction is delayed greatly and construction cost will run up so that two caissons are produced simulyaneously. The number of days required for production of two caissons is 30 days on a floating dock and 24 days on the sea or total 54 days. The floating dock is preferably moored along a wharf, but the existing public wharf at the site has no space permitting mooring so that the floating dock is placed in an adequate water area causing no hazard to the incoming and outgoing ships.

(3) For a floating dock, there are two plans: one is to bring a floating dock designed exclusively for production of concrete caissons from Japan; and the other one designed for shipbuilding from Surabaya.

9-2-5 Foreign Trade Pier and Other Facilities

(1) Foreign Trade Pier

The foreign trade pier required in 1985 is designed for 10,000 DWT vessels with a berth depth of −9m. In the long term development program up to 2000, the objective vessels are 15,000 DWT, and its berth depth is −10m. In the 1985 program, the future situation is taken into consideration, the design forces of the objective vessels at 10,000 DWT or 15,000 DWT and its berth depth at −9m or −10m are employed. However, the berth length employed is that for the objective vessel of 10,000 DWT (165m).

The pier structure is decided, as the result of comparative design, to be Alternative plan A (steel pipe pile open type pier). A standard cross section and a plan of Alternative plan A are shown in Figs. 9-1 (1) and (2) respectively.

A wharf is comprised of several blocks, one block being length 30m x width 18m. The steel piles are of a size of diameter 700mm, thickness 14mm − 16mm and pile length 23m − 23.5m. The number of piles per block is 4 piles x 7 lines = 28 piles.

They have the electrolytic protection applied for the first 20 years and, for the remaining 30 years, have a thickness allowance of 1mm − 3mm against natural corrosion. The portion above +1.00m is particularly subject to V type, 500H, length 2.50m and one Bollard of 35t type per block. The thickness of the slab of concrete is 0.3m, and the concrete beam height

is 1.2m.

The bulkhead has the mound prepared by small stone and rubble, cellular concrete blocks piled in two stages and coping concrete mixed and placed in site. The wave height being 1.2m, the weight of armor stone is set at about 200kg/piece. At the site, stones are hardly obtainable so that they have to be transported from Sulawesi and are, therefore, expensive. Thus, it is designed to use small stone partly for economy of the construction cost. The front slope grade of the mound is set at 1:1.5, and the back slope grade at 1:1.2.

The apron have a width of 25m, and the portion other than the concrete slab of the wharf is paved with asphalt. The apron has a drainage grade of 1%.

(2) Service Vessels Wharf.

The service vessels wharf is intended for smaller vessels than 500 DWT. In the 1985 program, it is used as a mooring wharf for small service vessels. In the 2000 program, it is to be used as a wharf for 300 GT car ferries. Standard types of the objective vessels are:

500 DWT (Length overall 43m x Extreme breadth 7.8m x Molded depth 3.8m x Full draft 3.5m); and

300 GT car ferry (Length overall 42m x Extreme breadth 10m x Molded depth 3.5m x Full draft 3.0m).

The structure of the wharf is a steel pipe pile open type wharf. It is shown in Figs. 9-6 (1) and 9-6 (2). The approaching velocity is V = 0.30m/sec.

(3) Jetty (Kampung Baru).

Adjacent to the existing concrete jetty (5) (50m x 7m) in Kampung Baru, a jetty (50m x 7m) is constructed toward north. The objective vessels are small sailing boats and local vessels. The structure of the jetty is a steel pipe pile jetty. It is shown in Fig. 9-7.

(4) Temporary Revetments.

The structure of the temporary revetments is, rubble mound revetment. From the difference in the ground height, they are classified into three types of A, B and C.

The structure of the temporary revetments is shown in Fig. 9-8.

(5) Reclamation.

The present ground height of the area to be reclaimed is from −10m to +3.5m. After reclamation, the ground height will be from +4.25m to +4.5m. The volume of soil for reclamation is 905,000m^3, and the area of reclamation is 208,000m^2.

(6) Transit Shed.

One transit shed is constructed, in a size of width 50m x length 120m or 6,000m^2. They are made of steel frame in 2 spans, one span being 25m. The uniform load is 3t/m^2. The floor is made of concrete. The roof is made of corrugated asbestos cement sheet.

(7) Plan of Port Facilities

The plan of port facilities is shown in Fig. 9-9.

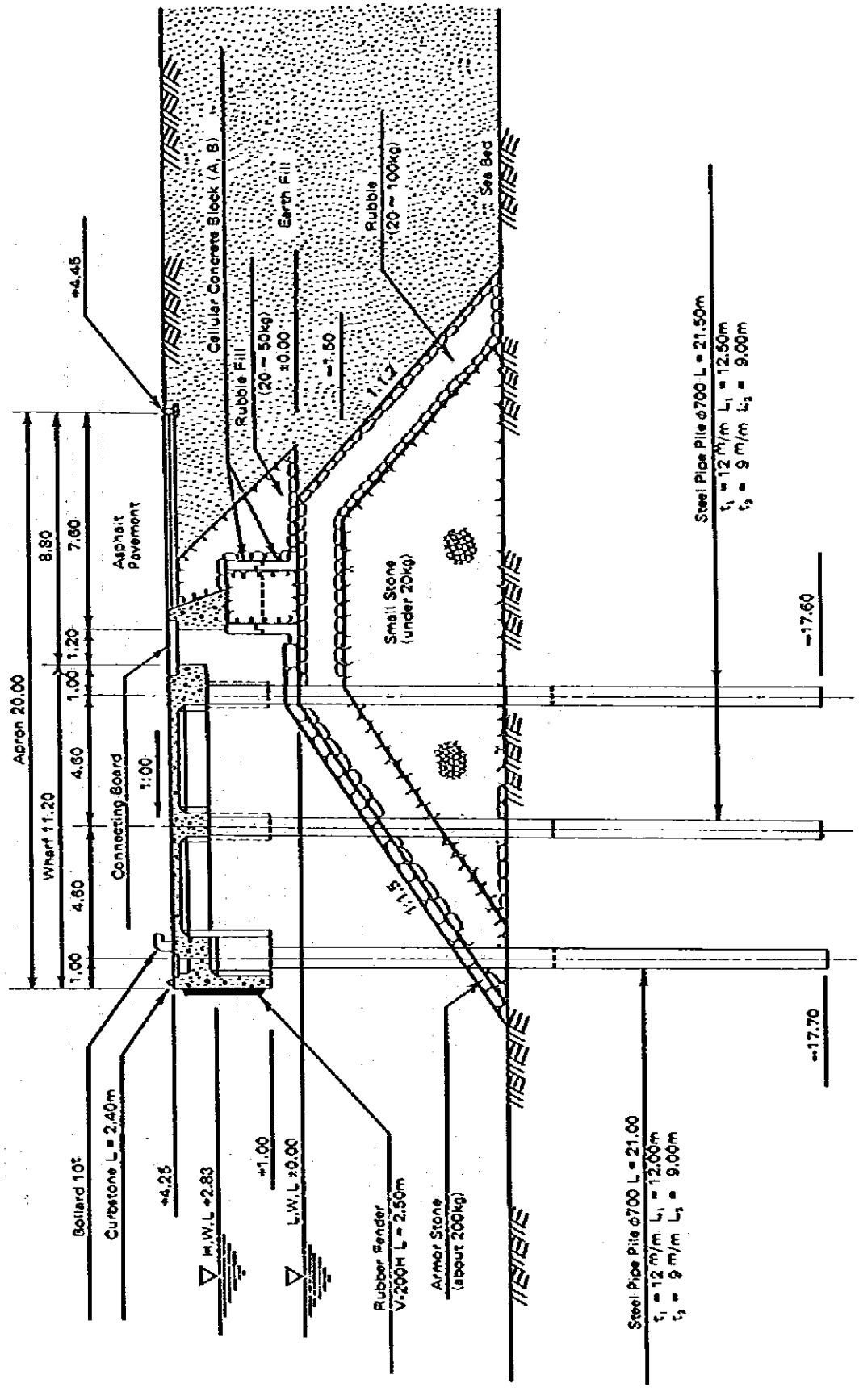


Fig. 9-6 (1) Service Vessels Pier Standard Cross Section

Fig. 9-6 (2) Service Vessels Pier Plan

Scale 1:200

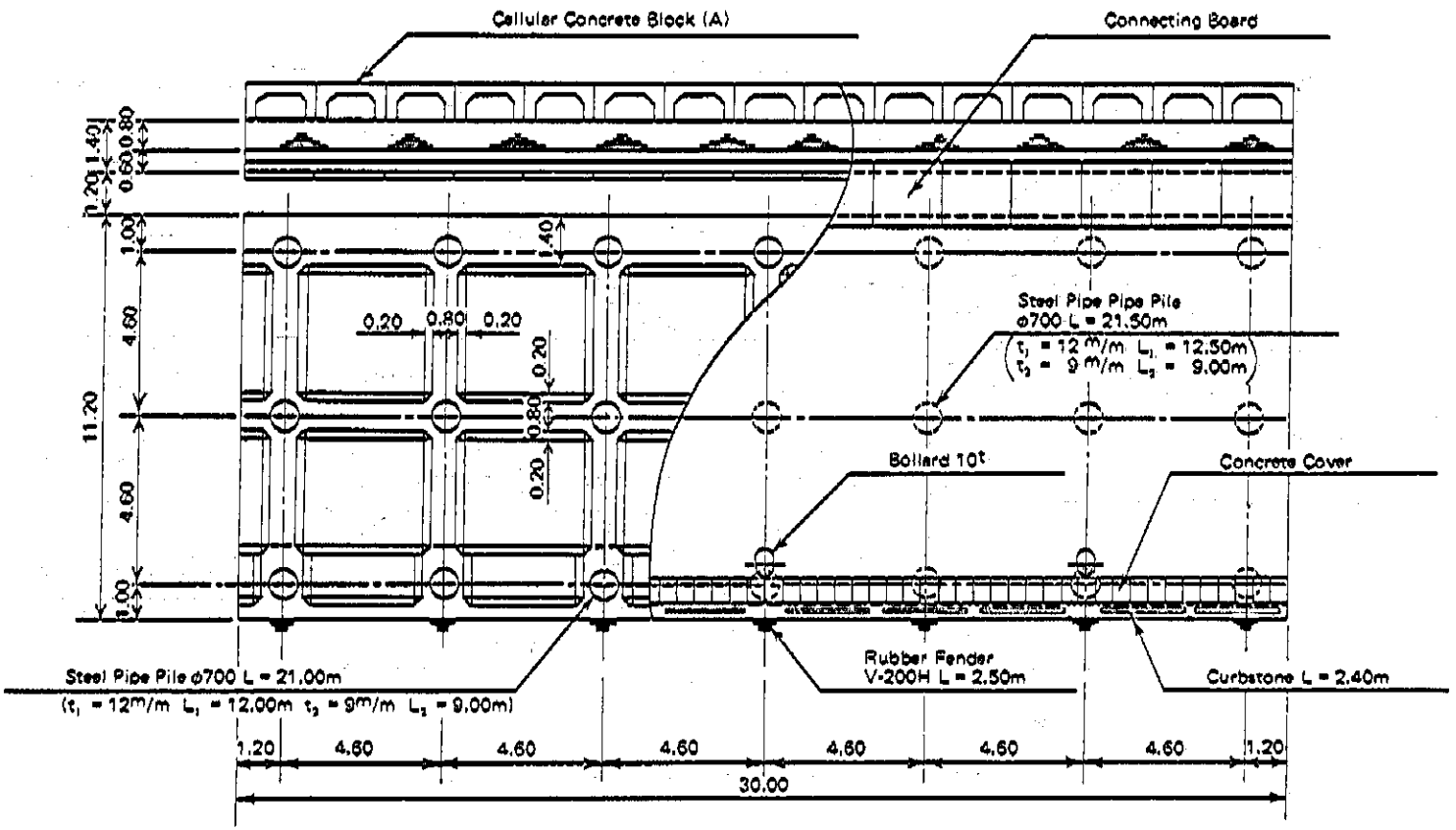


Fig. 9-7 Jetty (Kampung Baru)

Standard Cross Section and Plan Scale 1:200

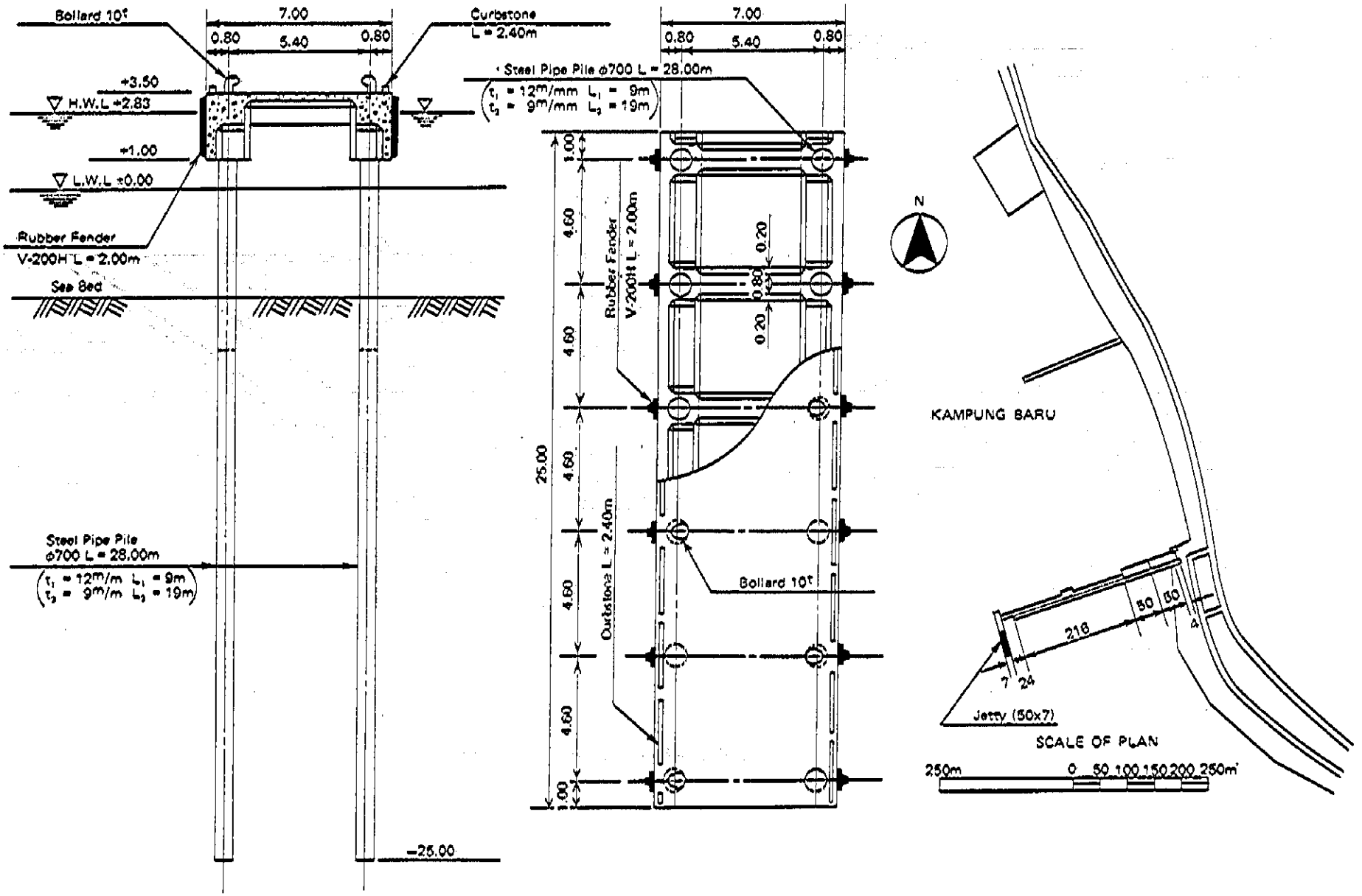


Fig. 9-8 Temporary Revetment 1:200

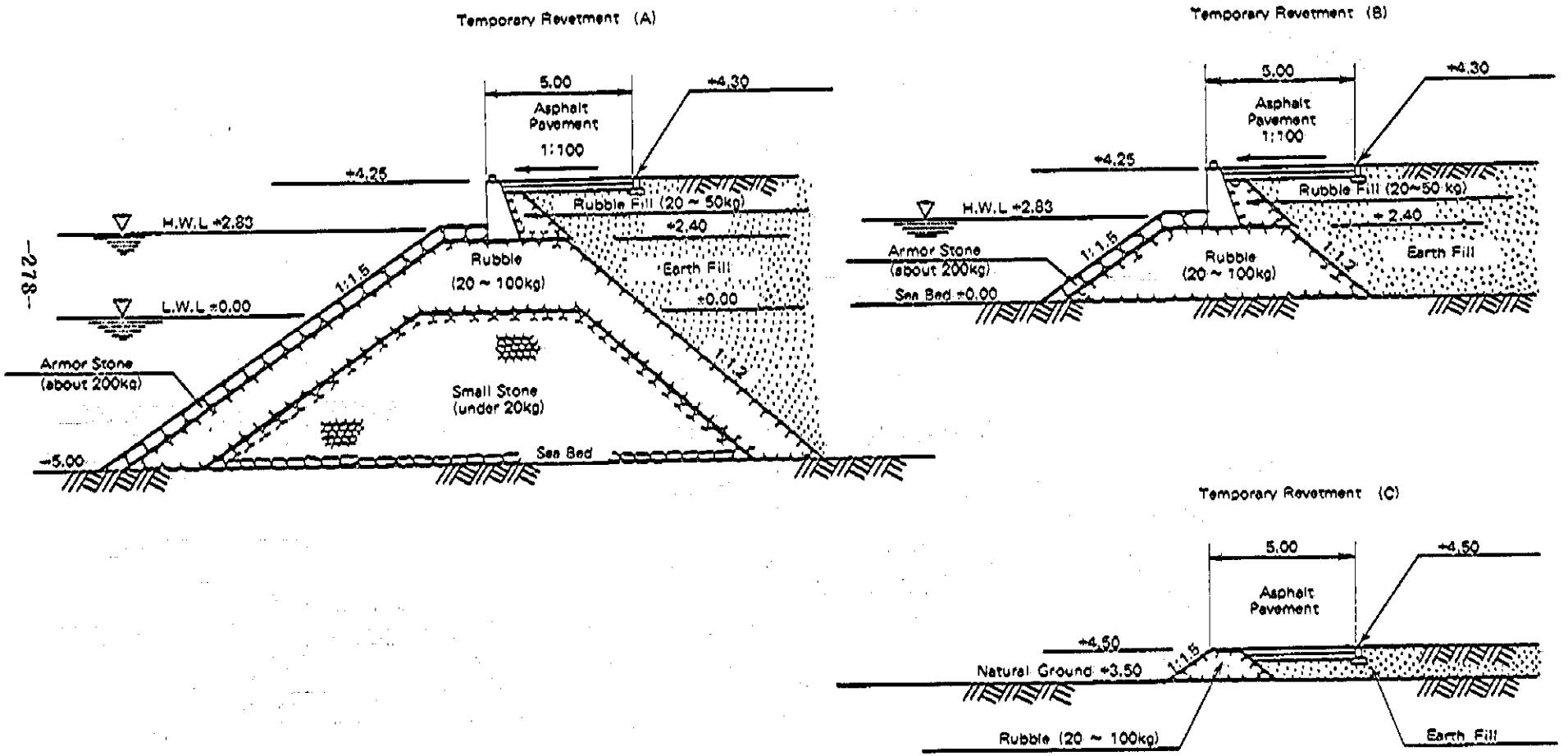
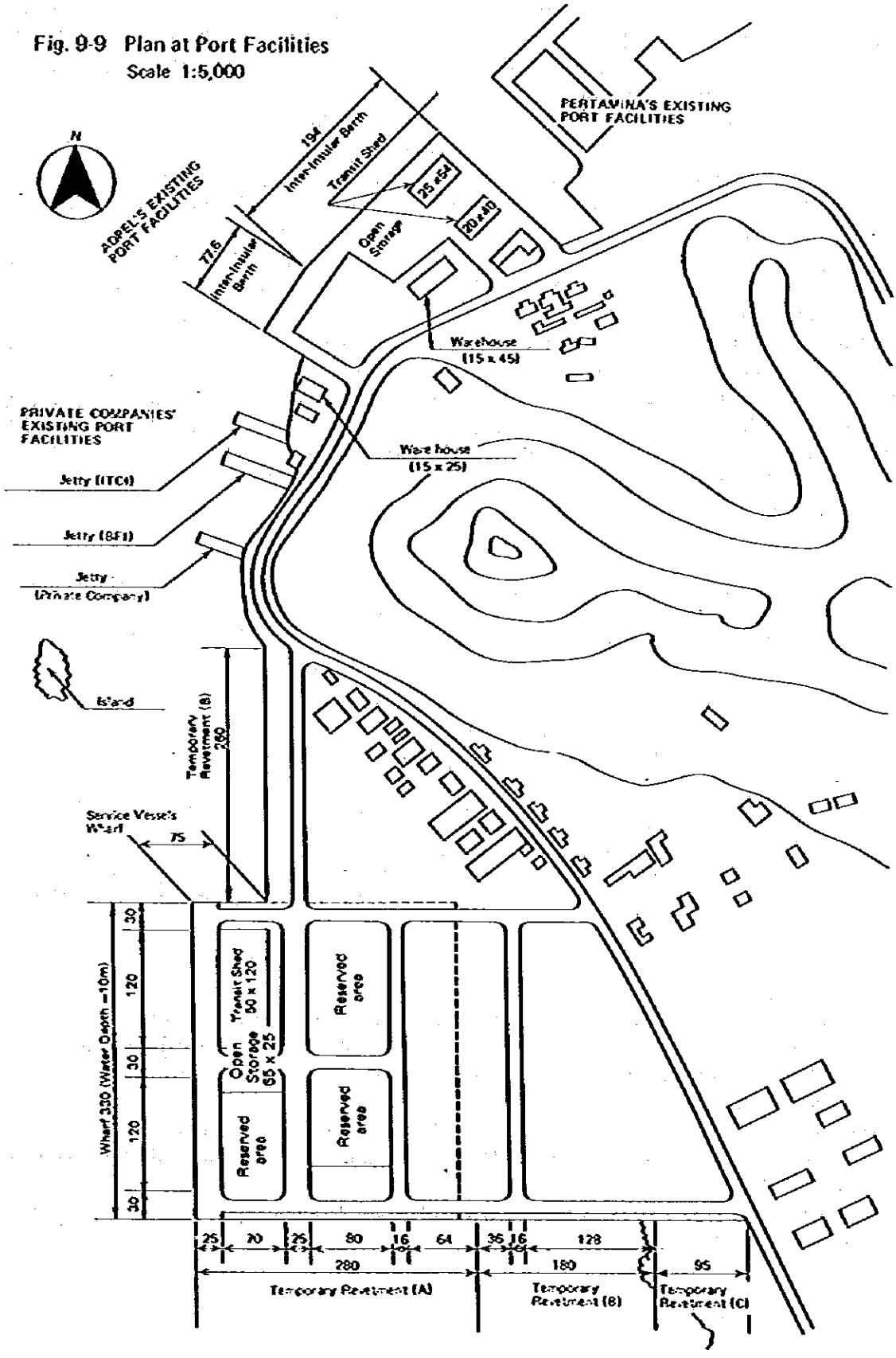


Fig. 9-9 Plan at Port Facilities
Scale 1:5,000



9-3 Construction Schedule.

The construction schedule for short term development program is shown in Table 9 -8. The construction period for this development program is 4 years from January 1981 to December 1984. From January 1985, effective use of all port facilities will be insured to cope with the cargo volume of 1985. The soil investigation, the hydrographic survey and the engineering study will be started in January 1981, and the mobilization in October 1981. A pump dredger is used for reclamation so that it is required to be completed for the bulkhead of the wharf and temporary revetments before the reclamation is started. The wharf being a steel pipe pile open type wharf, pile driving of the steel pipe piles must be completed prior to the small stone and the rubble work of the bulkhead. Pile driving is first made for the service vessels wharf in order to secure the temporary yeard and the construction craft mooring place and from technical of the construction. Next, it is made for the foreign trade pier. After completion of the pile driving, he bulkhead of the wharf is constructed. The construction of the temporary revetments is made at the same time of the pile driving. After completion of the bulkhead of the wharf and the temporary revetments, the reclamation is made in use of a pump dredger. After completion of the reclamation, the earth work of road is initiated. 2 berths of foreign trade pier are completed by August 1983. After settlement of the reclaimed ground, the works of water supply, electric power supply, drainage and road pavement are started from September 1983. The work of navigation aids in constructed by the end of 1983. In 1984, one transit shed, open storage, building, pavement around the transit sheds and other works (gardens) are carried out.

The jetty of Kampung Baru is constructed in 1984.

9-3-1 Foreign Trade Pier

(1) The bulkhead of the wharf has the mound made of small stone and rubble. Leveling of the rubble bed in the sea water is made by divers.

(2) For setting of cellular concrete blocks, a mobile crane (25t) is mounted on a 200t barge, which is used as a floating crane.

9-3-2 Reclamation.

(1) Reclamation is made by a pump dredger (D 2,600HP).

(2) The discharge length is assumed to be 2,200m, and the soil to be sandy with N value at 5. The work conditions at the site are considered to be good to permit 18 hours operation a day. Assuming the removed sea sand to be 11,000m^3/day and the proportion of removed sea sand remaining in the area of reclamation to be 80 percent, the volume of soil for reclamation is 8,800m^3/day.

(3) At least a period of 4 to 6 months is required before the ground settles after the completion of the reclamation. Therefore, it is, important to complete a series of works of pile driving, revetment and reclamation as soon as possible for the succeeding transit shed and other works.

(4) A pump dredger is brought from Singapore.

9-4 Cost Estimate

The required quantities of materials are sought from the structural form determined by comparative design and other facilities. The most economical construction method is employed among other practicable methods. Based on the unit cost obtained through the field survey, the construction cost is estimated by summing up the costs of each detailed work.

The construction cost of short term development program is shown in Table 9-9.

The construction cost of short term development program by each year (1981 ~1984) is shown in Table 9-10.

The construction cost of foreign trade pier (steel pipe pile open type pier—design water depth −9.0m) is shown in Table 9-11.

Table 9-8 Construction Schedule for Short Term Development Program

Item				1981						1982						1983						1984						1985					
No.	Description	Unit	Quantity	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12
1	-10m Wharf	m	330																														
2	Service Vessels Wharf	m	75																														
3	Jetty (Kampung Baru)	m	50																														
4	Temporary Revetment	m	815																														
5	Reclamation	m^3	905,000																														
6	Transit Shed	m^2	6,000																														
7	Open Storage	m^2	1,625																														
8	Building	m^2	30																														
9	Road	m^2	35,600																														
10	Drainage	sum	1																														
11	Pavement (Around Transit Sheds)	m^2	12,800																														
12	Water Supply	sum	1																														
13	Electric Power Supply	sum	1																														
14	Navigation Aids	sum	1																														
15	Cargo Handling Equipment	sum	1																														
16	Port Service Vessels	sum	1																														
17	Others	sum	1																														
18	Mobilization/Demobilization	sum	1																														
20	Engineering Study (including site survey)	sum	1																														
21	Supervision	sum	1																														

Table 9-9 Construction Cost of Short Term Development Program

Item No.	Description	Unit	Quantity	Unit Price			Amount		
				Local Currency US$	Foreign Currency US$	Total Unit Price US$	Local Currency US$ 1.000	Foreign Currency US$ 1.000	Total Amont US$ 1.000
1	Foreign Trade Pier	m	330	6,400	8,000	14,400	2,112	2,640	4,752
2	Service Vessels Wharf	m	75	5,710	5,070	10,780	428	381	809
3	Jetty	m	50	1,420	3,420	4,840	71	171	242
4	Temporary Revetment	m	815	1,190	520	1,710	970	424	1,394
5	Reclamation	m^3	905,000	0.1	1.6	1.7	91	1,448	1,539
6	Transit Shed	m^2	6,000	99	198	297	594	1,188	1,782
7	Open Storage	m^2	1,625	11	7	18	18	11	29
8	Building	m^2	30	253	66	319	8	2	10
9	Road	m^2	35,600	21	9	30	748	320	1,068
10	Drainage	sum	1				415	0	415
11	Pavement	m^2	12,800	11	7	18	140	90	230
12	Water Supply	sum	1				210	242	452
13	Electric Power Supply	sum	1				76	220	296
14	Navigation Aids	sum	1				4	32	36
15	Cargo Handling Equipment	sum	1				0	44	44
16	Port Service Vessels	sum	1				0	968	968
17	Others	sum	1				15	0	15
18	Mobilization/Demobilization	sum	1				83	372	455
19	Sales Tax (5%)	sum	1				299	0	299
	Sub Total (A)						6,282	8,553	14,835
20	Engineering Study (including site survey)	sum	1				115	259	374
21	Supervision	sum	1				214	514	728
	Sub Total (B)						329	773	1,102
22	Physical Contingency (15%)	sum	1				942	1,283	2,225
23	Price Contingency (15%)	sum	1				1,133	1,593	2,726
	Sub Total (C)						2,075	2,874	4,949
	Total (A+B+C)						8,686	12,200	20,858
							(41.6%)	(58.4%)	(100%)

Table 9-10 Construction Cost of Short Term Development Program by Each Year (1981~1984)

Unit, 1,000 US$

Item				1981			1982			1983			1984			Grand Total		
No.	Description	Unit	Quantity	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
1	Foreign Trade Pier	m	330	105	132	237	1,205	1,505	2,710	802	1,003	1,805				2,112	2,640	4,752
2	Service Vessels Wharf	m	75	143	127	270	285	254	539							428	381	809
3	Jetty (Kampung Baru)	m	50										71	171	242	71	171	242
4	Temporary Revetment	m	815	162	71	233	808	353	1,161							970	424	1,394
5	Reclamation	m^3	905,000				46	724	770	45	724	769				91	1,448	1 539
6	Transit Shed	m^2	6,000										594	1,188	1,782	594	1,188	1,782
7	Open Storage	m^2	1,625										18	11	29	18	11	29
8	Building	m^2	30										8	2	10	8	2	10
9	Road	m^2	35,600							332	142	474	416	178	594	748	320	1,068
10	Drainage	sum	1							138	0	138	277	0	277	415	0	415
11	Pavement (Around Transit Sheds)	m^2	12,800										140	90	230	140	90	230
12	Water Supply	sum	1							70	81	151	140	161	301	210	242	452
13	Electric Power Supply	sum	1							25	73	98	51	147	198	76	220	296
14	Navigation Aids	sum	1							4	32	36				4	32	36
15	Cargo Handling Equipment	sun	1				0	15	15				0	29	29	0	44	44
16	Port Service Vessels	sum	1				0	440	440				0	528	528	0	968	968
17	Others	sum	1										15	0	15	15	0	15
18	Mobilization/Demobilization	sum	1	17	11	28	21	175	196	3	164	167	42	22	64	83	372	455
19	Sales Tax (5%)			21	0	21	118	0	118	71	0	71	89	0	89	299	0	299
20	Engineering Study (including site survey)	sum	1	115	259	374										115	259	374
21	Supervision	sum	1	16	40	56	66	158	224	66	158	224	66	158	224	214	514	728
22	Physical Contingency (15%)			67	51	118	372	520	892	224	333	557	279	379	658	942	1,283	2,225
23	Price Contingency (15%)			97	104	201	438	622	1,060	267	407	674	331	460	791	1,133	1,593	2,726
	Total			743	795	1,538	3,359	4,766	8,125	2,047	3,117	5,164	2,537	3,524	6,061	8,686	12,202	20,888

Table 9-11 Construction Cost of Foreign Trade Pier (Steel Pipe Pile Open Type Pier
---- Water depth in front of Pier : --9.0m)

(Unit; US$)

No.	Item	Size/Quality	Unit	Quantity	Unit Price	Total
I	Direct Cost					
1.	Steel Pipe Pile Driving		sum	1		122,235
2.	Concrete Placing		sum	1		77,485
3.	Rubber Fender and Others		sum	1		36,229
4.	Bulkhead		sum	1		112,011
	Sub Total					347,960
II.	Indirect Cost	(I)x0.027	sum	1		9,400
	Total (I+II)					357,360
III.	Miscellaneous Expenses at Work Site	(I+II)x0.10	sum	1		35,740
IV.	Overhead	(I+II+III)x0.10	sum	1		39,310
	Grand Total (I+II+III+IV)					432,410

432,410 US$/30m ≒ 14,400 US$/m

No.	Item	Size/Quality	Unit	Quantity	Unit Price	Total
1.	Steel Pipe Pile Driving					
1-1	Steel Pipe Pile	φ700	piece	28	3,783	105,911
1-2	Carriage of Pile		"	28	80	2,240
1-3	Pile Driving	Vertical Pile	"	28	483	13,524
1-4	Cutting of Pile Head		"	28	20	560
	Sub Total					122,235
2.	Concrete Placing					
2-1	Support		m^2	540	8.2	4,428
2-2	Stage		"	293	2	586
2-3	Concrete	σ28=240kg/cm²	m^3	433	64.9	28,102
2-4	Form		m^2	1,051	6.1	6,411
2-5	Reinforcing Bar		t	56.290	531.3	29,907
2-6	Joint	t=20mm	m^2	11	15	165
2-7	Curbstone	L=3.20m	piece	8	6.2	50
2-8	Connecting Board		"	15	216	3,240
2-9	Concrete Cover		"	60	15.5	930
2-10	Corrosion Preventive Cover		"	21	146	3,066
2-11	Corner		m	30	20	600
	Sub Total					77,485
3.	Rubber Fender and Others					
3-1	Rubber Fender	V-500H L=2.50m	piece	3	7,870	23,608
3-2	Bollard	35t-Type	"	1	1,254	1,254
3-3	Mooring Ring	φ0.30m	"	6	8	48
3-4	Electrolytic Protection	20 years	sum	1		11,319
	Sub Total					36,229

No.	Item	Size/Quality	Unit	Quantity	Unit Price	Total
4.	Bulkhead					
4-1	Small Stone	under 20kg	m^3	2,514	13	32,680
4-2	Rubble	20~100kg	"	1,481	17	25,177
4-3	Armor Stone	about 200kg	"	282	19.4	5,471
4-4	Leveling of Rubble (under Block)		m^2	123	24.3	2,989
4-5	Leveling of Rubble		"	302	5	1,514
4-6	Leveling of Armor Stone		"	564	12.9	7,276
4-7	Cellular Concrete Block	(A-Type)	piece	15	432	6,480
4-8	Cellular Concrete Block	(B-Type)	"	15	531	7,965
4-9	Setting of Block		"	30	105	3,150
4-10	Stone Fill	under 10kg	m^3	102	13	1,326
4-11	Leveling of Stone Fill		m^2	39	2.4	94
4-12	Coping Concrete	$\sigma 28$=160kg/cm^2	m^3	59	57.3	3,381
4-13	Form (for Coping)		m^2	136	6.1	830
4-14	Stage (for Coping)		m^2	164	2	328
4-15	Joint (for Coping)	t=10mm	"	6	7.7	46
4-16	Rubble Fill	20~50kg	m^3	402	13	5,226
4-17	Leveling of Rubble Fill		m^2	228	0.7	160
4-18	Mat	t=3mm	m^2	177	20.6	3,646
4-19	Asphalt Pavement		"	156	24.5	3,822
4-20	Concrete Wall		m	30	15	450
	Sub Total					112,011