Part 6 MASTER PLAN AND SHORT-TERM PLAN OF SAMARIDA PORT

25. PORT DEVELOPMENT SCENARIO

25.1 Industrial Development Potentials

25.1.1 Economic Activity

Population of East Kalimantan Province has been increasing at average growth rate of 3.5% during the last decade, and reached 2.5 million in 1999 (Table 25.1.1). Population density in East Kalimantan is quite low at around 10 persons per square kilometers, although Samarinda City and Balikpapan City have high population density at 700 to 1,000 persons per square meters (Table 25.1.2). The increase of GRDP from 1993 to 1999 was 36.1%, with the electricity/water supply and transportation/communication sector recording the highest increase of around 70 %.

The regional income of East Kalimantan Province mainly relies on primary products such as mining and electricity. In particular, crude petroleum, natural gas and coal provide a great contribution to the national economy with export value of average US$ 4.7 billion recently. On the other hand, agriculture, livestock, forestry and fishery production have been relatively in a lower position in East Kalimantan Province.

Table 25.1.1 Population by District in East Kalimantan

District	Year 1990	Year 1995	Year 1999
Pasir	211,658	232,893	301,414
Kutai	552,031	641,482	823,038
Berau	62,353	90,064	75,484
Bulungan	152,150	176,741	272,078
Balikpapan	310,537	350,332	442,060
Samarinda	407,897	444,698	602,406
Bulungan (Tarakan)	81,149	99,315	-
Kutai (Bontang)	66,976	73,463	-
Total	1,844,751	2,108,988	2,516,480

Table 25.1.2 GRDP by Business Field at Constant Market Price of 1993 in East Kalimantan

(Unit: Million Rp.)

Business Field	Year 1993	Year 1996	Year 1999
Agriculture	1,364,606	1,794,162	1,702,427
Mining	4,799,550	5,921,899	6,738,547
Processing Industry	5,399,868	6,349,795	7,021,855
Electric and Flesh Water	45,184	58,265	75,642
Building	433,008	612,804	567,193
Trading, Hotel and Restaurant	1,430,950	1,836,855	1,906,007
Transportation and Communications	1,355,092	2,049,261	2,257,788
Financial, Leasing and Housing Services	534,480	706,462	590,978
Services	345,681	462,689	522,923
Total	15,708,419	19,792,192	21,383,360

25.1.2 Prospects of Major Sectors

(1) Natural Resources

East Kalimantan Province has much potential for coal mining, oil, natural gas, forestry and agriculture. Among them, the dominant industries compose of oil, natural gas, and coal mining at this moment. Oil, natural gas and coal are non-renewable resources that are exploited and predictably exhausted, while forestry and agricultural resources are renewable, accordingly, need to be utilized in a sustainable manner.

Table 25.1.3 Mineral Resources Production in East Kalimantan

Resources (Unit)	1997	1998	1999
Oil (MMSTB)	10,870	78,275	70,205
Natural Gas (MMSCF)	468,962	1,785,885	1,561,679
LNG ('000 M3)	34,376	36,913	NA

Table 25.1.4 Forest Production in East Kalimantan

(In 1999)

Forest Products	East Kalimantan	Indonesia
Logs (m3)	5,534,000	19,027,000
Sawn Timber (m3)	188,582	2,707,221
Plywood (m3)	1,196,552	7,154,729
Veneer (m3)	21,621	NA
Chips (m3)	13,374	NA
Pulps (m3)	-	NA
Blockboard (m3)	91,329	NA
Moulding/Dowel (m3)	59,979	NA

(2) Processing Industry

East Kalimantan Province is developing the industrial sector to strengthen its economic structure focusing on mining processing industry, forest industry and agricultural products processing industry. Among them, mining processing industry is the most successful economic sector in terms of the contribution to the regional economy as well as to the nation's economy. The estimated amount of oil, natural gas and coal deposits is quite enough and satisfactory. Thus, intensification of natural resource utilization in a sustainable way and steady industrialization by relevant private sector should be the basic policy to bring about economic success in East Kalimantan. On the other hand, forest and agricultural industry produce semi-finished products such as plywood, processed woods, and rubber. In order to make those industries more attractive to the regional economy, value-added industrialization is required. In addition, further industrial development requires efficient ports, which can help distribute the products both domestically and internationally.

25.1.3 Prospects of East Kalimantan Economy

To sum up, the prospects of East Kalimantan economy in the next 5-10 years are promising, particularly in mining industry and agricultural development. On the other hand, appropriate measures should be taken to preserve the existing forests since the resources have been greatly depleted. Forest preservation will lessen the siltation in the rivers and can lead to the creation of an eco-tourism industry. Human resource development is also important to help the local labor force enter high value-added industries.

26. DEMAND FORECAST

26.1 Capacity of the Existing Port

The existing terminal at Samarinda has 2 container berths, 5 general cargo berths, and 1 passenger terminal. The container wharves have no container crane system, thus requiring ship gear/mobile crane handling. Based on the baseline productivity (Table 26.1.1) and the maximum berth occupancy (Table 26.1.2), the cargo handling capacity at the existing Samarinda Port is calculated as shown in Table 26.1.3.

Table 26.1.1 Baseline Productivity

Cargo type	Productivity
General Cargo	20 (t/gang/hour)
Bagged Cargo	25 (t/gang/hour)
Unitized Cargo	30 (t/gang/hour)
Liquid Bulk	120 (t/hour)
Dry Bulk	90 (t/hour)
Container (Full Container Terminal)	20 (TEU/crane/hour)
Container (Conventional Terminal)	10 (TEU/crane/hour)

Source: JICA Team

Table 26.1.2 Maximum Berth Occupancy

Number of berths in the group	Recommended maximum berth occupancy (%)
1	40
2	50
3	55
4	60
5	65
6-10	70

Source: Port Development, UNCTAD

Table 26.1.3 Capacity of the Existing Samarinda Port

Facility	Number of Berths	Productivity	Capacity
Container Wharf	2	10 TEU/hour	47,000 TEU/year
General Cargo Wharf	5	20 ton/hour, 2 gangs	607,000 ton/year
Passenger Terminal	1		292,000 persons/year

26.2 – 26.5 Demand Forecasts For Samarinda Port

The socio-economic framework of Samarinda port development included recent trends in GRDP, population, traffic and national economic recovery. Samarinda is within East Kalimantan province which is oil and mineral rich. (Its GRDP is 5 times larger than Jambi).

East Kalimantan province had been growing by nearly 6-7 % in real terms before the economic crisis, but recent growth has been about 3 %. Predictions in other studies suggest about 4.6 % per year up to 2010. Long term growth rates of about 4 % are considered to be achievable. However, this will depend partly on national economic and political stability.

Apart from the macro economic basis, trends in traffic were examined including bulk cargoes such as coal and timber and planned industrial development. It is clear that East Kalimantan has substantial natural resources and agricultural potential. Currently, coal makes up 50 % of all cargoes at Samarinda.

The provincial government has implemented a development zone called SASAMBA which comprises the area between and including Samarinda and Balikapapan (from where most of East Kalimantan oil is shipped). Economic growth potential is high and the current port is very congested and lacks space for expansion.

Unlike Jambi, few containers are handled by the private wharves at Samarinda.

The two scenarios for Samarinda are related to the provision of 4 or 6 container berths.

Forecasts were made by public and private facilities and by main commodities. Public cargoes were then detailed and divided into container and general cargo traffic, as well as bulk traffic where relevant to public facilities. Forecasts were also made by detailed commodity, allowing containerisability analysis to be undertaken, to assist the container forecasts.

Total Samarinda port/river traffic has been growing by about 6 % per year with public cargoes also growing strongly by nearly 8 % per year, depending on the years selected.

Growth rate forecasts for both 4-berth and 6-berth scenarios are:

Total Cargo (Public and private)	4-6 % (short-long term)
Public cargo	6-9 %
Public Containers	14-5 %

Part of the basis for the cargo comes from the proposed expansion of coal traffic as reported by several shippers. Also part of this expansion will come from the recovery of the domestic power generation industry which uses coal.

Passenger traffic is expected to grow by about 3 % and is relatively conservative since an alternative route exists via Balikpapan port and then by road which saves about a day in travel time. Further, Samarinda is relocating its city centre airstrip and direct flights to Samarinda are envisaged in the longer term.

27. NATURAL CONDITION SURVEY AT SAMARINDA

27.1 Natural Condition Survey

As Part of the planning of this Study, the Natural Condition Survey at Samarinda as described below has been implemented by subcontracting with local consultants in Indonesia. To determine the natural conditions of the Study sites, some items of the survey were executed in both dry and rainy season as shown in Table 27.1.1.

Table 27.1.1 Natural Condition Survey Items and Execution Period at Samarinda

Survey Items	Location	Survey in dry season	Survey in rainy season
		July – Aug. 2001	Nov. – Dec. 2001
1. Topographic survey (1:1,000)	Samarinda port	●	
	Palaran		●
2. Sounding survey (1:1,000)	Samarinda port	●	
	Palaran		●
3. Sounding survey (1:10,000) Including dual frequency sounding	Navigation channel	●	●
4. Current observation	Samarinda	●	●
	S. Mariam		●
	Pendingin	●	●
	Muara Kembang	●	●
	Muara Pegah	●	
5. Wave observation	Muara Pega	●	●
6. Tide observation	Samarinda	●	
	Muara Kembang	●	
7. Soil investigation and laboratory test	Samarinda port	●	
	Palaran		●
8. Seabed soil sampling and laboratory test	Navigation channel	●	
9. Existing wind data correction and analysis	Balikpapan	●	

27.2 Topographic Survey

27.2.1 Samarinda Port

Samarinda City is located on the flat land about 65 km upstream from the mouth of Mahakam River. Samarinda Port is situated most east of the center of Samarinda City on the left bank of Mahakam River.

Samarinda Port was constructed within Samarinda City and the site is extremely narrow (width about 50 m to 70 m) because it is limited by the existing roads. The ground of Samarinda Port is soft and some port facilities foundations have subsided because they were constructed on reclaimed land on the left bank of Mahakam River. In particular, ground subsidence of 30 cm at maximum has been caused in the container yard by comparison with pier height.

The results of topographic survey show that the height of the site within Samarinda Port

is about +3.2 m (NLLW). The water depth in front of Samarinda Port is about –6 m (NLLW). It is reported that dredging is made as it is needed.

27.2.2 Palaran

Palaran is located on the right bank of Mahakam River at about 13 km in a straight line to the southeast from the center of Samarinda City. As Palaran is on the opposite bank of Mahakam River to the center of Samarinda City, it is necessary to cross a bridge upstream of the River which takes about 45 minutes by vehicle. Most of the road from the center of Samarinda City to Palaran is paved except in the vicinity of the Project site. Some section of this road are now undergoing expansion work.

Palaran is located on flat land on the right bank of Mahakam River about 50 km upstream from the river mouth (about 15 km downstream from Samarinda City). A hill of about 50 m high is located about 500 m behind the riverbank line, and the road to Palaran from Samarinda City leads from the rear side of the hill. Palaran village is located on the upstream side of the project site and a factory is on the downstream side.

27.2.3 Topographic survey

For the planning and designing of the port facilities, 1:1,000 scale topographic maps at Samarinda Port and Palaran were prepared by terrestrial survey method.

The survey elements for this topographic survey are as follows:

1)	Projection	UTM (Universal Transverse Mercator) Zone No. 50
2)	Spheroid	WGS 84
3)	Datum elevation	NLLW (Nearly Lowest Low Water) decided by tide observation and harmonic analysis

27.2.4 Sounding survey

For the planning and designing of port facilities at the proposed port site and also for the study and planning of dredging at channel on Mahakam River, 1:1,000 scale bathymetric maps covering the water area in front of proposed port site and 1:10,000 scale bathymetric maps covering Mahakam River from Samarinda to river mouth were prepared.

The survey elements for this sounding survey are as follows:

1)	Projection	UTM (Universal Transverse Mercator) Zone No. 50
2)	Spheroid	WGS 84
3)	Datum elevation NLLW	NLLW (Nearly Lowest Low Water) decided by tide observation and harmonic analysis

27.2.5 Sounding survey by dual frequency

The sounding survey along Mahakam River and channel was carried out using two different frequencies (namely, 210 kHz and 33kHz).

From these results, it is presumed that the uppermost part of riverbed and channel in Mahakam River and Outer Bar has a relatively soft clay or sand layer approximately 45 – 70 cm thick. From investigation by bottom sampling, it appears that clay is distributed at the river mouth, while the bed materials containing less clay and more sand are more upstream of Mahakam River. The thickness of this soft layer at river mouth is thicker than upstream.

27.3 Subsoil Condition

27.3.1 Soil Investigation

To determine the soil condition of the proposed port sites, offshore and onshore boring were executed at Samarinda Port and Palaran. Soil laboratory test, consisting of water content, grain size analysis, unit weight test, unconfined compression test and consolidation test, were executed using obtained disturbed and undisturbed soil samples.

27.3.2 Samarinda Port

The layer from the ground surface to approximately –11 m depth (NLLW) consists of mainly soft silt or clay, however, the layer below –11 m depth consists of mainly fine to medium sand. The layer that is clearly the supporting layer with the N-Value of 50 or more consists of fine to medium sand and lies at approximately –73 m (NLLW).

Although this supporting layer lies at about –73 m depth (NLLW) at the center and at the downstream part of Samarinda Port, it is located at –63 m in depth (NLLW) at the upstream part of Samarinda Port.

27.3.3 Palaran

The layer from the ground surface to approximately –15 m depth (NLLW) consists mainly of soft silt or clay, however, the layer below –15 m depth (NLLW) to supporting layer consists of mainly fine to medium sand.

The layer that is clearly as the supporting layer with N-Value of 50 or more consisting of clay lies at an approximately –25 m in depth (NLLW) at the center and downstream part of proposed port site, and at an approximately –41 m in depth (NLLW9 at the upstream part of proposed port site.

27.4 River Channel and Sedimentation

27.4.1 Riverbed Soil Sampling and Analysis

To investigate the soil materials of the riverbed on Mahakam River and the seabed on channel at Outer Bar, soil sampling was made at the intervals of approximately 3 km between Samarinda Port and Outer Bar. Soil laboratory tests, consisting of water content,

grain size and unit weight, were executed on the obtained soil samples.

From the investigation of the bottom soil samples, it is clear that clay and clayish sand is distributed at the river mouth, while the bed materials contained less silt and clay, and more sand are more upstream on the bottom of Mahakam River.

27.4.2 Soil laboratory test

The characteristics of the riverbed and channel bottom materials are summarized as follows:

1) From the results of grain size analysis, the percentage of sand was less than 50 %, except GS-15 (81 %).
2) Grain size analysis shows that the riverbed materials near Tanjung Sanga Sanga (from GS-06 to GS-08) and Pulau Kerbau (from GS-13 to GS-15) contain more sand and less clay compared to other locations.
3) The density of riverbed materials at the location of sedimentation in the river was estimated based on the soil laboratory test. The estimated densities of riverbed materials were between 1.4 g/cm^3 – 1.8 g/cm^3. It appears that the riverbed materials of upper layer of Mahakam River are relatively soft and loose.
4) The thickness of this soft and loose upper layer is estimated as approximately 45 – 70 cm from the results of dual frequency sounding survey and obtained core length.
5) The fluid mud on the top of riverbed was not detected. It is presumed that it had flowed away due to high speed current (Maximum velocity is more than 1.0 m/sec and average velocity is more than 0.3 m/sec).

27.4.3 Relation between sounding survey and maintenance dredging

Since Mahakam River has a large volume of sediments in the river and its estuary, this river has been divided into five survey zones for yearly sounding surveys and for eventual maintenance dredging by IPC4. For this Study, existing sounding survey data is very useful for the estimation of riverbed change. Furthermore, for this Study, new sounding surveys were executed in July and November 2001.

Table 27.4.1 Sounding and maintenance Dredging from 1998 to 2000 at Samarinda

Year	Month	Sounding／Dredging	Area-1	Area-II	Area-III	Area-IV	Area-V
1998	May	Pre-dredge sounding	○	○	○	○	○
	----	Maintenance dredging	○	○	○	○	○
1999	Feb.	Final sounding	○	○	○	○	○
2000	March	Final sounding	○	○	○	○	○
	May	Pre-dredge sounding	○	○	○	○	○
	----	Maintenance dredging	○	○	○	○	
	Oct.	Final sounding	○	○	○	○	

27.4.4 Estimation of Riverbed Variation by the Existing Sounding Data

Using the existing sounding survey data, the cross section of each Spot and the longitudinal profiles of the channel were prepared. The water depths at the same Spot

were compared to estimate the riverbed variation. As a result, the following features were verified.

1) In the maintenance dredging areas, Area Ia and Area Ib showed the most rise in riverbed, which was approximately 80 cm or more per year at the center of the channel.
2) In the maintenance dredging areas, Area V Utara showed the least rise in riverbed, which was approximately 10 cm or less per year at the center of the channel.
3) The rise in riverbed was most at the center of the channel and the rise of the riverbed was lower as the distance from the center of the channel increases.

27.4.5 Estimation of riverbed variation by the new sounding survey data

Using the new sounding survey data (dry and rainy season), the cross sections at 500 m intervals and the longitudinal profiles of Mahakam River between Samarinda Port and river mouth were prepared. The depths at the same cross section lines were compared to estimate the riverbed variation. As a result, the following features were verified.

1) In each maintenance dredging area, riverbed had risen about 40 – 50 cm per year at the river and channel center except Area V Utara.
2) In non-dredging area, the riverbed rise is very small. The estimated riverbed rise per year in non-dredging was less than 10 cm.

27.5 Tide and Current

27.5.1 Current Observation

To determine the characteristics of current in Mahakam River and channel in Outer Bar, current observations were executed in both dry and rainy season at similar observation points as in dry.

27.5.2 Relation between prevailing current direction and tide

The relations of prevailing current direction with the rise and fall of the tide as obtained from the observations are shown in Table 27.5.1 "Relation between Tide and Prevailing Current Direction"

The prevailing current direction in dry season at Mahakam River and channel was the same as the flow line of Mahakam River and channel, and the current direction reversed between the low tide to high tide and the high tide to low at the current observation point.

However, in rainy season, prevailing the prevailing current directions at the time from low tide to high tide at Samarinda, Sungai Mariam and Muara Kembang are not so clear.

Table 27.5.1 Relation between Tide and Prevailing Current Direction

Location	Current Observation Depth	Prevailing direction			
		Dry season (July 2001)		Rainy season (Nov. 2001)	
		Low⇒High	High⇒Low	Low⇒High	High⇒Low
Samarinda	4.5 m above river bed	315 degrees	135 degrees	----	----

	1.5 m above river bed	315 degrees	135 degrees	Not clear	135 degrees
Sungai Mariam	1.5 m above river bed	----	----	Not clear	110 degrees
Pendingin	4.5 m above river bed	350 degrees	170 degrees	----	----
	1.5 m above river bed	350 degrees	170 degrees	355 degrees	175 degrees
Muara Kembang	4.5 m above river bed	10 degrees	190 degrees	----	----
	1.5 m above river bed	10 degrees	190 degrees	5 degrees	Not clear
Muara Pegah	4.5 m above river bed	10 degrees	190 degrees	----	----
	1.5 m above river bed	10 degrees	190 degrees	----	----

27.5.3 Current velocity

The characteristics of current in the Study area are summarized as follows:

1) The average velocity of the upper layer (4.5 m above riverbed) was higher than the lower layer (1.5 m above riverbed).
2) The maximum velocity of the upper layer was higher than the lower layer.
3) The current velocity maximum occurred during the middle period from high tide to low tide and from low tide to high tide.
4) The prevailing current direction was the same direction of river flow of Mahakam River or channel.
5) The percentage of current direction toward upstream in the rainy season was very small compared to dry season.

Table 27.5.2 Average and Maximum Velocity of Current

Location	Current Observation Depth	Velocity (cm/sec)			
		Average velocity (m/sec)		Maximum velocity (m/sec)	
		Dry season	Rainy season	Dry season	Rainy season
Samarinda	4.5 m above river bed	0.25 m/sec	----	0.66 m/sec	----
	1.5 m above river bed	0.23 m/sec		0.74 m/sec	0.77 m/sec
Sungai Mariam	1.5 m above river bed	----		----	1.27 m/sec
Pendingin	4.5 m above river bed	0.31 m/sec	----	0.91 m/sec	----
	1.5 m above river bed	0.28 m/sec		0.98 m/sec	0.88 m/sec
Muara Kembang	4.5 m above river bed	0.31 m/sec	----	1.20 m/sec	----
	1.5 m above river bed	0.21 m/sec		0.88 m/sec	0.96 m/sec
Muara Pegah	4.5 m above river bed	0.26 m/sec	----	1.05 m/sec	----
	1.5 m above river bed	0.16 m/sec	----	0.74 m/sec	----

27.5.4 Harmonic analysis of current

The harmonic analysis of current at Muara Pegah was executed to determine the characteristics of current at Mahakam River. The results of harmonic analysis are shown in Table 27.5.3.

Table 27.5.3 Tidal Constituent at Muara Pegah

Type	M2	S2	K1	O1	P1	N2	K2	M4	MS4
V (m/sec)	0.432	0.237	0.134	0.053	0.139	0.004	0.221	0.018	0.036
Phase lag (deg)	93.1	217.0	302.6	187.1	92.6	333.8	350.2	345.7	60.5

27.5.5 Tide Observation and harmonic analysis

A tide gauge was installed at Samarinda Port and Muara Kembang to make a tide

observations. To decide the datum elevation for topographic survey and sounding survey, tidal observations over a period of 30 days were executed.

Based on the observed tidal data at Samarinda, harmonic analysis was executed to calculate the tidal constituents. Nearly Lowest Low Water (NLLW) as a datum elevation for topographic survey and sounding survey was decided based on the calculated tidal constituents. The calculated value of Z_o (the difference between the Mean Sea Level and NLLW) by harmonic analysis was 1.10 m.

27.5.6 Datum Level for sounding survey

According to the information of IPC-4, the datum level for sounding survey was –1.60 m below LWS. The value of Z_o shown in the tide table issued by the Government of Indonesia was also 1.3 m. However, the value of Zo calculated by the harmonic analysis was 1.10 m. It is presumed that the reason of these differences was caused by the following.

1) Difference of the tide observation location
   According to the tide table of the Government of Indonesia, tide gauge was located at Samarinda City. The tide of this Study also set up at Samarinda Port. However, tide gauge of IPC-4 seems to be located at river mouth.
2) Difference of the tide observation period and season
   Due to the short Study period, the tide observation period of this Study is one month. However, tide observation period for tide table issued by the Government of Indonesia maybe be more than 1 year.
3) Influence of river flow
   The tide observation of this Study was executed in dry season (July – August). The water level of Mahakam River at dry season is lower than rainy season. To determine more accurate datum level, it is necessary to execute more than one year's observations.

27.6 Wave

27.6.1 Wave observation

A wave gauge was installed at the mouth of Mahakam River and 30 days continuous measurements of wave height and wave direction were made to obtain the basic data for the siltation modeling. The wave observation was carried out at the dry season (July - August 2001) and the rainy season (November 2001; this failed due to the trouble of the wave gauge).

27.6.2 Wave analysis

(1) Observed wave

The wave direction is nearly constant, mainly in the directions from S, but partially the waves from NE – E were seen. The outline of wave height and wave period is shown in

Table 27.6.1 “Results of Wave Observation at Outer Bar of Mahakam River”.

Maximum wave height was less than 0.4 m and average wave height was 0.1 m. Wave period of the observed wave height was about 4 sec.

Table27.6.1 Results of Wave Observation at Outer Bar of Mahakam River

Item	Dry season		Rainy season	
	Wave height	Wave Period	Wave height	Wave Period
Maximum wave	0.38 m	3.5 sec		
Significant wave	0.08 m	4.0 sec		

(2) Wave hindcast

Wave hindcast at the offshore point of Mahakam River was carried out using the wind data at the airport of Balikpapan for four years (1998 – 2001. The hindcast wave height is rather low and is generally less than 0.1 m. Average wave height of the frequent high waves is about 0.4 m.

(3) Consideration of wave in siltation modeling

Average wave height at the Outer Bar area of Mahakam River is generally small and the frequency of the wave height exceeding 0.1 m was only 2.6 %.

The observed orbital velocity of water by waves is within 0.05 – 0.1 m/s, while the average velocity of tidal current at the Outer Bar area reaches 0.25 – 1.05 m/s.

The shear stress by wave action over the sediment at the Outer Bar area of Mahakam River is very small and less than 10 % of that of tidal current. The contribution of the wave action to the sediment transport is negligibly small at the Mahakam River.

28. ENVIRONMENTAL CONDITION

28. 1 Environmental Characteristics of Development Site (Mahakam Basin)

Mahakam River is the third longest river in Indonesia (after Kapuas 1,143km, Barito 900 km, Mahakam 775km). It flows from the mountainous interior of the island to the east coast Makassar Strait.

(1) Deforestation in River Basin

In 1992, East Kalimantan suffered from a great fire especially in the Mahakam River Basin. Therefore, the deforestation rate in this period was different from the normal rate. Forest area in Kalimantan have been exploited intensively from 1970s. According to World Bank's estimation area reduction, forest area in Kalimantan was 50 million hectare in 1900, but it is estimated to be reduced to 25 million hectare by 2010.

(2) The Estimation of Soil Erosion Caused by Deforestation

The estimated soil erosion is shown in Table 28.1.1

Table 28.1.1 Eroded Soil caused by Deforestation

Mahakam	Basin area : 9,264,200 ha Deforestation area (ha)
1,998	3,095,866

Mahakam	Forest area (ha)	Farmland and others(ha)	Eroded soil volume(t/yr.)
1992	7,733,241	1,530,958	**2,910,389**
1998	4,637,375	4,626,824	**8,421,031**
volume in unit area (t/ha yr.)	0.02	1.8	

(3) Deforestation area and soil erosion volume in the Mahakam Basin

According to the result of the soil erosion calculation, the eroded soil in 1992 was 2,910 x 10^3 tons per year, and it reached 8,421 x 10^3 tons per year in 1998. Hence, eroded soil increased almost 5 million tons within 6 years after the great fire and constant felling of trees.

28.2 Environmental Survey

(1) Environmental Survey in the Development Areas

Environmental survey was conducted in the proposed development areas, Samarinda. Environmental survey items we as follows: 1) Water Quality, 2) Riverbed Quality, 3) Air Quality, 4) Noise and Vibration, 5) Social Environment, 6) Land Use, 7) Traffic Volume,

8) Fauna and Flora. The result of the survey is shown in Table 28.2.1

Table 28.2.1 The Result of the Environmental Survey

Survey Items	Survey Result Summary
1.Water Quality	18 parameters were surveyed. The downstream of the Samarinda is populated and there are factories and docks that drain waste water; therefore, coliform and some heavy metals exceeded the standards.
2.Riverbed Quality	9 parameters were analyzed. Particle size is relatively big and sandy. Low content of organic matter.
3.Air Quality	Since Palaran is far from polluting sources, air quality is good. The air quality in Samarinda port itself is relatively bad caused by the pollutants from the roads behind the port ,but it is still fair compared with the standards.
4.Noise and Vibration	The sources of noise and vibration in Samarinda port are from the roads behind the port; a sawmill factory is the source of noise at Palaran site. The noise is below 60B generally. It is a not notably noisy environment.
5.Social Environment	Questionnaire surveys were conducted around the study areas. Most of the respondents gave favorable answers to the project because new projects will bring the opportunity of the employment in Samarinda.
6.Land Use	There are populated commercial and residential areas around the existing Samarinda port. Around the Palaran site, there are sawmill factory, residential, orchards, bushes, but no paddy.
7.Traffic Volume	The roads behind the port has heavy traffic in the city.
8.Fauna and Flora	Two natural protected areas near Samarinda. No protected species inhabit the proposed site in Samarinda.

29. SITE SELECTION

29.1 Planning Aspects

29.1.1 Container Terminal

(1) Candidate Port Development Sites

The existing Samarinda Port is extremely congested with increasing port cargo and passengers. Containerization has been also accelerated year by year. The port needs to cope with containerization very urgently. Needless to say, container cargo handling requires a large amount of space behind a wharf. The necessary depth of a container terminal should be at least 200 m. However, the breadth of wharves at the existing port is only 40 m to 75 m. In addition, there is no more extension area on both sides of the port, because the port has been completely surrounded by the central business district of the Samarinda City. Therefore, the existing port is not suitable for container cargo handling, which will be dominant cargo at Samarinda in the near future. In spite of this, the port has to accept a rapidly growing container cargo at the existing port until a new container terminal is developed and operational.

On the other hand, the existing port is still useful for general cargo handling, because it is provided with 827 m long wharves with 40 m to 75 m wide yard behind them. If the existing port is specialized in a general cargo port, the port function is fully strengthened and efficiently utilized. From this point of view, the Study Team recommends a new container terminal development in other place, which is able to secure the sufficient container cargo handling space within a terminal. At the same time, the existing port should be used as a general cargo terminal in the long run, and the existing passenger terminal should be relocated when the existing port is filled with gradually increasing general cargo in future.

There are three candidate places for a new container terminal within the port hinterland of Samarinda. The first is Marang Kayu, facing the open sea and 50 km away from the City of Samarinda (Figure 29.1.1). The second is Mangku Palas, owned by IPC 4, and on the opposite site of the Mahakam River to the existing port (Figure 29.1.2). And the third is Palaran, the former timber factory, now under mortgage to the Indonesian Bank Restructuring Agency (IBRA), 14 km downstream on the opposite site of the Mahakam River to the existing port (Figure 29.1.3).

(2) Preliminary Master Plan Study at Marang Kayu

1) 6 Meter-draft Container Port Plan

a. Project Profile

The layout Plan for 2025 is shown in Figure 29.1.4. Main components of the plan are shown in Figure 29.1.5. The Study Team plans to create a new modern container terminal at Marang Kayu on condition

that the port basin will not be buried under coastal drift sand when a breakwater is extended up to –3m depth water area. This plan also requires land acquisition, a large amount of capital dredging, long breakwater construction, river estuary works and long port access road.

b. Container Terminal

- Terminal

The area for the proposed container terminal can be estimated with the following formulas.

- Container terminal area = (Container yard area) / (Yard area ratio)
  = 14.7 ha (2025)
- Container yard area = (Ground slots) / (Land use ratio)
  = 8.8 ha (2025)
- Ground slots = (Container volume) * (Dwelling time) / (Yard operation ratio) / 365 / (Stacking height)
  = 2,277 TEUs (2025)

where:

Yard area ratio : 0.6 (CFS within the terminal)
Land use ratio : 260 TEU / ha (RTG system)
Dwelling time : 5 days
Yard operation ratio : 0.6
Stacking height : 4
Container volume : 399,000 TEU / year (2025)

- Depth of the terminal = (Terminal area) / (Quay length)
  = 196 m (2025)

Considering the layout of container terminal facilities, the Team proposes 250 m (including the apron of the wharf) as the depth of the terminal area in 2025. Consequently, the container terminal area turns out to be 19 ha.

- CFS

Assuming the depth of CFS as 40 m and the width of a bay as 8 m, the actual area will be 8,320 m2 in 2025.

- Handling equipment

Taking into account the following factors, a RTG system is recommended for the yard operation.

i) Linear quay alignment.
ii) Reliability of equipment.
iii) The terminal will be open to multiple users.
iv) The terminal requires high stowing capacity to maximize the operational income.

In order to provide a quayside productivity of 20 TEU/hour/berth, each berth needs to have a gantry crane. Each gantry requires two RTG and four yard tractors.

c. Cost Estimation

The cost estimation of a new container terminal at Marang Kayu is based on the following assumption. The construction cost of 6 m-draft container terminal at Marang Kayu is shown in Table 29.1.1.

① A new container terminal site at Marang Kayu is chosen in the inner bay sheltered by the Marang Kayu Peninsula.
② A drift sand protection jetty is effectively functioned when the jetty is extended up to –3 m depth water area.
③ The width of a long access channel is designed to secure 1.5 * LOA for safety channel navigation of inland container vessels.
④ The river configuration of Sungai Marangkayu, a small river which is going down to the inner bay, is reconverted to the open sea in order to prevent from river soil sedimentation.
⑤ The unit price of breakwater construction at Marang Kayu is the same as actual results of breakwater construction at similar seaports in Indonesia.
⑥ The unit price of dredging cost at Marang Kayu is the same as the unit dredging cost at the Mahakam River and its estuary.
⑦ The unit price of wharf and yard construction at Marang Kayu is the same as the unit construction cost at Palaran, estimated by the Study Team.

2) 12 Meter-draft Container Port Plan

a. Project Profile

The layout plan for 2025 is shown in Figure 29.1.6. Main components of the plan are shown in Figure 29.1.7. The Study Team plans to create a new large-scale modern container terminal at Marang Kayu on condition that the port will not be buried under coastal drift sand when a breakwater is extended up to –3m depth water area. This plan is conceived in order to examine the possibility of a large-scale, deep sea port within the Samarinda Port hinterland which is able to accommodate international container vessels. Therefore, the wharf draft of this container port is –12m, just the same water draft as a new container port at Kariangau, East Kalimantan, which was studied and proposed by the Asian Development Bank in November 1996. 12 m-draft new container terminal plan also requires land acquisition, a large amount of capital dredging, long breakwater construction, river estuary works and long port access road.

b. Container Terminal

- Terminal

The area for the proposed container terminal can be estimated with the following formulas.

- Container terminal area = (Container yard area) / (Yard area ratio)
  = 18.3 ha (2025)
- Container yard area = (Ground slots) / (Land use ratio)
  = 11.0 ha (2025)
- Ground slots = (Container volume) * (Dwelling time) / (Yard operation ratio) / 365 / (Stacking height)
  = 2,850 TEUs (2025)

where:

Yard area ratio : 0.6 (CFS within the terminal)
Land use ratio : 260 TEU / ha (RTG system)
Dwelling time : 5 days
Yard operation ratio : 0.6
Stacking height : 4
Container volume : 499,000 TEU / year (2025)

- Depth of the terminal = (Terminal area) / (Quay length)
  = 183 m (2025)

Considering the layout of container terminal facilities, the Team proposes 250 m (including the apron of the wharf) as the depth of the terminal area in 2025. Consequently, the container terminal area turns out to be 25 ha.

- CFS

Assuming the depth of CFS as 40 m and the width of a bay as 8 m, the actual area will be 8,320 m2 in 2025.

- Handling equipment

Taking into account the following factors, a RTG system is recommended for the yard operation.

i) Linear quay alignment.
ii) Reliability of equipment.
iii) The terminal will be open to multiple users.
iv) The terminal requires high stowing capacity to maximize the operational income.

In order to provide a quayside productivity of 20 TEU/hour/berth, each berth needs to have a gantry crane. Each gantry requires two RTG and four yard tractors.

c. Cost Estimation

The cost estimation of a new container terminal at Marang Kayu is based on the following assumption. The construction cost of 12 m-draft container terminal at Marang Kayu is shown in Table 29.1.2.

① A new container terminal site at Marang Kayu is chosen in the inner bay sheltered by the Marang Kayu Peninsula.
② A drift sand protection jetty is effectively functioned when the jetty is extended up to –3 m depth water area.
③ The width of a long access channel is designed to secure 1.5 * LOA for safety channel navigation of inland container vessels.
④ The river configuration of Sungai Marangkayu, a small river which is going down to the inner bay, is reconverted to the open sea in order to prevent from river soil sedimentation.
⑤ The unit price of breakwater construction at Marang Kayu is the same as actual results of breakwater construction at similar seaports in Indonesia.
⑥ The unit price of dredging cost at Marang Kayu is the same as the unit dredging cost at the Mahakam River and its estuary.
⑦ The unit price of 12 m-wharf and yard construction at Marang Kayu is just the double price of wharf and yard construction at Palaran.

(3) Evaluation of Candidate Port Development Sites

All three candidate sites have advantages and disadvantages. In order to evaluate each alternative new port site, the Study Team has taken the following selection factors into account: (1) sufficient space for a new terminal, (2) possibility of land acquisition, (3) expected construction cost in consideration of engineering feasibility, (4) accessibility to a new terminal from the land side, and (5) potentiality of future port extension. The most important thing to identify the most preferable site is that creation of a deep-sea port for common-users is unlikely in the port hinterland of Samarinda, as the Samarinda Port is classified by DGSC as a tertiary trunk port for most of the cargo items. In order to construct a deep-sea port along the ocean coast including a long access road to Marang Kayu, a large amount of initial investment as well as the following maintenance cost is needed. Among the remaining two alternative riverside sites, Mangku Palas is not recommendable, because the land space is not enough to create a modern container terminal at this site. In addition, there is no more extension area at Mangku Palas. Therefore, the Study team recommends that public investment for the port sector should be focused on Palaran. The result of site selection for a new terminal is summarized in Table 29.1.8.

Table 29.1.8 Site Selection for a New Container Terminal

Factors of Site Selection	1. Marang Kayu	2. Mangku Palas	3. Palaran
Ownership	Very few local residence.	IPC IV has already acquired.	21 ha with 500 m riverfront is under the mortgage of IBRA, 56 ha is owned by a private timber company.
Space	Necessary area is provided on condition that all basic port facilities are created.	7.1 (ha) with 445 (m) riverfront has been acquired. More land acquisition is not possible.	Total area is 77 ha. Land acquisition has not been started, but 21 ha is under the mortgage of IBRA.
Deep-draft Quays	Creation of deep-draft quays is feasible, on condition that a large amount of capital dredging on the shallow ocean area.	The water draft is 6 m at most, since the site is along the Mahakam River.	The water draft is 6 m at most, since the site is along the Mahakam River.
Maintenance Dredging of Access Channel	Large volume of maintenance dredging is required every year, owing to rough and shallow ocean.	Certain amount of maintenance dredging is required to keep the water depth.	Certain amount of maintenance dredging is required to keep the water depth.
Calmness of Water Basin	Calmness of the water basin is not secured without a breakwater.	The water area is usually calm.	The water area is usually calm.
Accessibility	Very far from places of port users. Long trunk road construction for heavy load traffic is inevitable.	Access road must be constructed. Land acquisition for access road is also needed.	Access road to the regional highway is under construction by the private sector.
Initial Investment	All port facilities need to be created, that is, breakwater, entrance channel, water basin, wharf, container yard, CFS, in addition to necessary equipment for container handling. Therefore, the project will be economically infeasible.	Creation of wharf, container yard, CFS in addition to necessary equipment for container handling. Bad soil condition has been also identified by the Team's natural condition survey, thus initial investment cost will become large.	Creation of wharf, container yard, CFS in addition to necessary equipment for container handling. Reasonable soil condition has been identified by the Team's natural condition survey. Initial investment cost will be expected to become economically feasible.
Land Acquisition	The whole area is undeveloped, and there is very scarcely dense population. Thus, successful land acquisition will be anticipated.	Already acquired, but Infeasible for further land acquisition.	Possible. 21 (ha) among total land is under the mortgage to IBRA. The land owner is also cooperative with the Mayor Office's development policy.
Overall Evaluation	Not attractive.	Not attractive	Most attractive

29.2 Administrative Aspects

Samarinda port, which is located about 60km upstream from the mouth of the Mahakam River, is managed by IPC IV Samarinda branch office. According to the long-term demand forecast, the capacity of the present port facilities will not be sufficient to respond to the future demand. For this reason, the Study Team proposed a new container terminal at Palaran area opposite the present port. After this land is purchased, port working area will need to be established. An access road will be needed as well. There are timber factory and related buildings around the new site. Samarinda ADPEL is responsible for the safe navigation along the Mahakam River. The Port Working Area and The Port Interest Area in this river and around its river mouth should be reviewed to realize the best sharing scheme of dredging costs among the concerned parties.

29.3 Engineering Aspects

The existing Samarinda port has wharves of 700 m length and about 30 m land depth. The land area of the existing port is surrounded by the city and the main road of Samarinda, and thus has no space for the port expansion. To cope with the growing volume of the cargo traffic and ship calls, new sites for port development were recommended and the condition of each of the candidate sites was studied from the engineering aspects as described below.

(1) Marang Kayu

Marang Kayu is the candidate site of deep-sea port development that supersedes the existing Samarinda port recommended by the port authority of Samarinda. The notable geographical features of the Marang Kayu site are the well grown sand-spit and small, shallow bay (the water depth is assumed as LWS -2 to -3 m at the deepest) sheltered by the sand-spit. Based on the configuration of the sand-spit, there is dominative littoral sand drift in the southerly direction.

If a deep-sea harbour basin is secured outside of the sand-spit,

- A set of breakwaters will be necessary to secure the calmness of the basin from the waves of Selat Makassar,
- A set of sand barriers will be necessary to prevent the inflow of sand into the basin,
- A large amount of capital dredging work will be necessary since abundant littoral sand drift is assumed.

The condition of the road needs improvement of width and pavement and acquisition of the land area for the construction of the approach road to the site.

The conclusion is that the Marang Kayu site does not have particular advantage of deep-sea port development that supersedes the existing Samarinda port

(2) Mangkupalas

The site of Mangkupalas is located on the right bank of Mahakam River and is about 450 m in extension along the river and 150 m in land depth. The premises of 7.2 ha were purchased by the MoC in 1974 and were transferred to IPC4 later. Access is about 14 km from the existing Samarinda Port via Mahakam Bridge and the access road (provincial) is in the process of improvement to two lanes and 15 m width.

The shoreline of site has been eroded about 30 m by the floodwater of Mahakam River for 20 years and displays a very steep riverbed profile in front of the site. In order to secure the stability of the port facilities along the shoreline, construction of the shore protection works will be inevitable.

This site lacks depth of land as a container terminal. It will be necessary in the near future to secure another land area for container marshalling yard and empty van pool.

This site lacks the space for the further expansion after the “long term” development.

(3) Palaran

The site is located on the right bank of Mahakam River and access is about 20 km from the existing Samarinda Port via Mahakam Bridge. This site has the extension of over 500 m along shoreline. Water depth about 15 m will be secured nearby from the shoreline.

The land area consists of 21 ha of riverside premises and 53 ha of hillside premises. A bankrupt timber factory is still partially running with 253 employees. Land acquisition and the problems of compensation have not been concluded.

This site has experience to be inundated in 1987 and 1994 by the flood of Mahakam River. In order to secure the access road and safety against inundation, some large amount of earthwork will be inevitable.

The construction of access road (about 600 m in extension, cutting through a hill of 15 m height) will be needed.

30. MASTER PLAN

30.1 Channel Capacity

30.1.1 Number of Calling Vessels and Navigation Conditions

The purpose of this chapter is to calculate the vessel waiting time, in the access channel taking into account the navigation rules, based on the number of calling vessels in the year 2000, 2007 and 2025 according to the traffic forecast for each type of vessel. If the simulation yields an excessive waiting time, some measures will need to be taken.
A numerical simulation model "WITNESS 2000" was employed to evaluate the above.

30.1.2 Vessel Waiting Time in Mahakam River Channel

Two scenarios have been drawn up for the Short Term Plan (target year 2007) and Master Plan (target year 2025) of Samarinda: "Case 1 (Four-Berth Scenario)" and "Case 2 (Six-Berth Scenario)".
The simulation results show the channel waiting time is minimal in both cases. Therefore, there is no need to increase the depth and the width of the Mahakam River during the study period.
However, maintenance dredging will continue to be needed to keep a suitable channel depth.

30.2 Channel Sedimentation

(1) Maintenance Dredging

A very large-scale delta is formed at the river mouth of Mahakam River. The main navigation channel to Samarinda has 65 km extension from the south entrance of the delta and a 29 km portion of the navigation channel is maintained by dredging.

Although the original design section of the navigation channel had the following dimensions: bottom width: 80 m, depth: LWS-6.0 m, the dimension of the channel has changed in accordance with the limitation of the budget for maintenance dredging.

The average yearly volume of the dredging is about 1,600,000 m^3. The dredging work is carried out by hopper dredger and the dredged material is mainly sand and silt.

The dredging work in the year of 2001 is planned as 930,740 m^3 for the channel dimension of width: 70 m and depth: LWS -5.0 m. The expense is to be shared by the following public organizations.

DGSC:	670,238 m^3	(72.0 %; Area Ia, Ib)
IPC4:	70,504 m^3	(7.6 %; Area II, III, IV, V Utara)
PERTAMINA	189,998 m^3	(20.4 %; Area V Selatan)

(2) Sedimentation and Riverbed Changes

a) Area Ia - Ib

The biggest riverbed changes are seen in this division of the navigation channel on the Outer Bar area. The depth of the changes exceeds 1 m/year.

b) Area II - III

There are several deep-water portions with LWS-8 to -10 m along the river channel running through Mahakam Delta. These are the contraction of the curved channel where the flow velocity increases and three-dimensional complicated flow takes place.

The bottom elevation of the navigation channel won't become shallower than LWS-5 m in this division.

c) Area IV - V

The changes of depth in Area IV and Area V Utara are 0.2 to 0.3 m/year and are relatively small. Area V Selatan shows the biggest riverbed changes among this portion of the channel from 0.3 to 1.0 m/year.

(3) Bathymetric Survey of River Channel

Riverbed changes have very complicated aspects in the river channel in the delta of Mahakam River mouth. A big shoreline change and the erosion at the riverbank along

Mahakam River are visible in Mangkupalas and Palaran.

Bathymetric survey should be conducted periodically in the river channel from the river mouth up to Samarinda and the characteristics of the riverbed changes should be captured.

30.3 Optimum Dredging Plan and Countermeasures

(1) Technical evaluation of dredging method

Riverbed material The riverbed materials distributed from the Samarinda Port up to the estuary area of Mahakam River range from clay or silt, fine sand to medium sand.

Density in-situ estimated from the results of the physical test of the riverbed materials range from 1.40 to 1.81 g/cm^3 (1.6 g/cm^3 on average; water content: 65 %).

Dumping Area of dredged Soil In the case of Samarinda, the dredged soil dumping area is located at two sites. A dumping area established south offshore of the Mahakam Delta is used as the site for the dredged soil from the channel Area I, Area II and Area III. The location is about 6 miles offshore from the south end of the channel Area Ia and is over 30 m in depth.

The dredged soil from the channel Area IV and V is carried and dumped at a dumping area along the river channel in the middle of Mahakam Delta. The location is 6 – 8 miles from the working sites in the channel. These dumping areas are established at the appropriate locations.

(2) Maintenance dredging for port development

Maintenance dredging for port development The volume of maintenance dredging in the Mahakam River channel was about 1,000,000 m^3/year in 2001 (up to –5 m of channel depth). If the design depth of the navigation channel is secured up to –6 m accompanying port development at Palaran, the incremental volume is estimated as 600,000 m^3/year.

Effect of structural countermeasure The effect of the river structures to decrease the dredging volume was studied based on actual riverbed changes and also using numerical simulation of siltation.

The river channel in the Tanjung Sanga-sanga area has two major which lose its flow and speed along the channel at the branches. Hence, significant deposition is taking place in those parts of the navigation channel (Area V Selatan and Utara).

To block the branches of channel with a pair of Closing Dykes is considered in order to concentrate the river flow into the main stream of the channel and to decrease the volume of deposition. The total construction is assumed to be 900 m in length (400 m at the Selatan channel and 500 m at the Utara channel) with construction costing 9.0

million USD.

The effects of river structures to decrease the dredging volume are very limited. The reduction of the maintenance dredging volume by the Closing Dykes is estimated as 250,000 m^3/year（about 0.35 million USD/year）. The construction cost of the Closing Dyke is equivalent to the maintenance dredging cost over 26 years.

An economic analysis of this case shows that the present values of the cost and benefit balance after 45 years of the construction under the condition of the discount rate: 1 %, while the balance is gained after 51 years under the discount rate 1.5 %.

The merit from the siltation prevention measures with river structures is very limited and small considering the restriction to the use of the river channel and the miscellaneous environmental risks.

30.4 Channel Dredging Scheme

As the decentralization process progresses, local governments and the private sector are expected to play a greater role in realizing regional development.
The Team proposes a new cost-sharing scheme for maintenance dredging (Table 30.4.1). It is necessary to review the Port Working Area and Port Interest Area in Samarinda Port in line with the scheme.

Table 30.4.1 Conceptual Dredging Cost Sharing Scheme for Samarinda Port Master Plan

Parties Concerned	Current Scheme (until 1998)	Provisional Scheme (1999-2001)	Future Scheme (Draft)				Note (unit：million Rp)
			Maintenance Dredging 13,000m3/Rp		Initial Dredging		
			River Channel 400,000m3	Outer Channel (15.6 km) 1,200,000m3	River Channel	Outer Channel (15.6km)	
River Channels							
Central Government	50-100 %	50-90 %					
Port Authority IPC IV	0-50 %	10-50 %	2,600 (50%)				
Local Government	0 %	0 %	2,080 (40%) *-2		*-4		*-1
Related Business Circles (beneficiaries)	0 %	0 %	260(5%) *-2		*-5		Beneficiary Charge *-3
Calling Vessels (greater than 150 GRT)	0 %	0%	260 (5%) *-2		*-5		Channel Use Charge *-3
Sub-total	100%	100%	5,200 (100%)				
Outer channel							
Central Government				7,800 (50%)			
Port Authority IPC IV				7,800 (50%)			
Sub-total				15,600 (100%)			

Note: *-1 Subsidy (within the budgetary limitation) from Province and Municipality

Note: *-2 Share is conceptual. Thorough review is needed after the available amount of the balancing fund is determined.

Note: *-3 Beneficiaries include the owners of special ports and vessels larger than 150t

Note: *-4 IPC IV may ask for financial support after the available amount of the balancing fund is determined.

Note: *-5 IPC IV may ask for financial support after private industries start operation around Samarinda.

30.5 Vessels for Samarinda and their Cost for Container Transport

Samarinda can accept larger vessel, if the navigation channel approaching to the port can be maintained at the deeper draft . In other words, if the port stays at the present depth of the channel, a shorter L_{OA} vessel can be put into service to its designed (full load) draft, but a longer L_{OA} vessel can only be put into service to a shallower draft than her designed (full load) draft.

The cost of transport by one TEU container using shallow draft vessel (water depth 5m) is higher than that of transport by ordinary type vessel (water depth: 6 m) by about 7 %.

The cost of the container transport for the Samarinda ~ Surabaya ~ Samarinda route has been analyzed for ordinary and shallow draft vessels as follows:.

Samarinda ~ Surabaya ~ Samarinda Vessel Design and Container Costs

	L_{OA} (m)	B (m)	d (m)	TEU	DWT	COST/TEU (1,000Rp)
Ordinary type vessel, water depth 6m	149.0	18.0	5.5	350	6,300	1,510 (100)
Shallow draft vessel, water depth 5m	149.0	18.0	4.5	290	5,200	1,616 (107)

30.6 Capacity Requirements

30.6.1 Palaran Container Terminal

The Study Team prepares for two port development scenarios for a new container terminal at Palan. The first scenario is called 6-berth scenario, which is examined in case necessary waterfront for future container handling (750 m long) can be acquired in Palaran. This scenario assumes 18-hour operation and 20 TEU productivity of the terminal with one container crane. RTG system is also introduced in the terminal to carry out container handling operation at yard.
The other scenario is called 4-berth scenario, which is examined just in case further longer waterfront than 500 m at Palaran cannot be acquired. This scenario assumes 24-hour operation and higher productivity of the terminal in order to make up for the shorter quay length. Number of the handling equipment and depth of the terminal differ depending on the scenario.
Based on the following assumption, the capacity requirements for a new container terminal at Palaran are calculated as shown in Table 30.6.1.

(1) Traffic projection (See Section 26.3)
(2) Distribution of port functions between the existing terminal and Palan.
(3) Baseline productivity (See Section 26.1)
(4) Capacity of the existing port (See Section 26.1)

Table 30.6.1 Capacity Requirements at Palaran

Terminal	Facility	The Number of Required Berth			
		Short-Term (2007)		Long-Term (2025)	
		6-berth Scenario	4-berth Scenario	6-berth Scenario	4-berth Scenario
Palaran	Container	3	2	6	4

30.6.2 Existing Terminal at Samarinda

When a new container terminal at Palaran is operational, the entire waterfront of the existing terminal at Samarinda will be dedicated to general cargo wharves and the passenger terminal. Since general cargo demand will not grow fast, the required number of general cargo wharves will be provided within the existing terminal for some years after the relocation of container wharves to Palaran in 2007. However, the general cargo demand is predicted to grow up to more than 1.0 million tons/year in future. Thus, further creation of wharves within the existing terminal, will be needed to make the entire waterfront available for general cargo handling in the long run. In this connection, the existing passenger terminal also needs to be relocated to make more room for general cargo.
Based on the following assumption, the capacity requirements for the existing general cargo terminal

and a new passenger terminal, are calculated as shown in Table 30.6.2.

(1) Traffic projection (See Section 26.3)

(2) Distribution of port functions between the existing terminal and Palan.

(3) Baseline productivity (See Section 26.1)

(4) Capacity of the existing port (See Section 26.1)

Table 30.6.2 Capacity Requirements at Existing Terminal

Terminal	Facility	Short-Term (2007)	Long-Term (2025)
Existing Samarinda	General Cargo	4	9
Selili	Passenger	0 (1 Berth at Samarinda)	1

30.7 Alternative Layout

Palaran is the most recommendable project site for a new container terminal at Samarinda. The 6-berth container terminal requires some 20 ha land for a yard, and 750 m waterfront for a wharf. 77 ha land at Palaran is under the mortgage of IBRA (the Indonesian Bank Restructuring Agency), accordingly the necessary land area for a new terminal will be successfully acquired. However, the available waterfront for a new terminal right now is 500 m only, which is also under the mortgage of IBRD, and will be able to provide 4 container berths for a terminal. In order to realize a modern full container terminal at Palaran, further land acquisition is needed.

In case of unsuccessful further waterfront acquisition than 500 m waterfront at Palaran, the Study Team recommends another candidate project site at Mangku Palas, just the opposite side of the Mahakam River to the existing Samarinda Port. The alternative project site at Mangku Palas is able to provide 7 ha land area and some 400 m waterfront for a new container terminal. This means that a 2-berth container terminal will be constructed at Mangku Palas, but not a 6-berth container terminal. Therefore, the alternative project at Mangku Palas still needs the original port development project at Palaran. The Mangku Palas new port project accompanied by the Palaran's 4-brth scenario, is able to create a long-term full container terminal in the Samarinda region.

The Study Team has also examined the possibility of a new oceanfront full container terminal at Marang Kayu, some 50 km away from the city of Samarinda, also facing the open sea in the Makassar Strait. But, both the cost estimation and the economic analysis show that a new port project at Marang Kayu is not viable due to a huge amount of cost required by the project implementation in terms of initial construction cost and maintenance dredging cost as well.

According to the preliminary site selection survey by the Mayor Office at Samarinda, the necessary land and waterfront at Palaran will be possibly acquired. The Mayor Office is also preparing to assign the district of Palaran as the city's industrial zone. Some manufacturing factories are also supporting a new container terminal project at Palaran, which will realize the cost reduction of seaborne cargo transport between East Kalimantan and East Java. Taking all above into consideration, the Team recommends a full-scale container terminal development plan at Palaran.

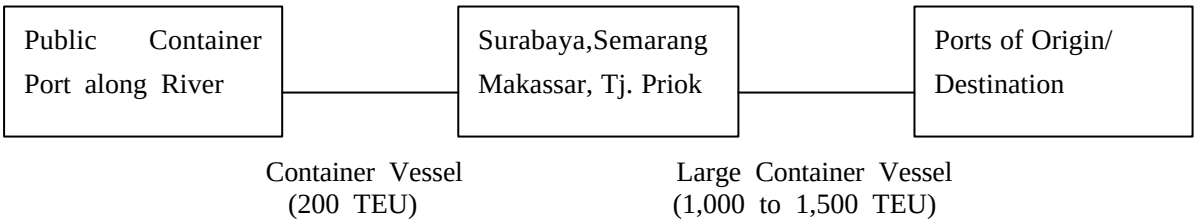
Regarding a new passenger terminal, the Study Team recommends Selili as the most appropriate project site among 5 alternative construction sites. There are 5 alternatives for a new passenger terminal, that is, Selili, Sungaikerbau, Sungaikapih, Muarasambutan, and Pulau Atas. All alternative sites locate on the same bank of the Mahakam River, and are not so distant from the city center of Samarinda. In this sense, all alternatives have their own strong candidacy. However, the land acquisition at Sungaikerbau, Sungaikapih and Muarasambutan is highly depending on the possibility of the relocation of land ownership at each site. The location of Pulau Atas is slightly questionable in terms of easy access to the city center of Samarinda. Taking all above into consideration, the Team proposes that a new passenger terminal should be constructed at Selili, possibly acquirable 7 ha land, located on the same bank of the Mahamam River, and easy access to the city center.

30.8 Master Plan for 2025

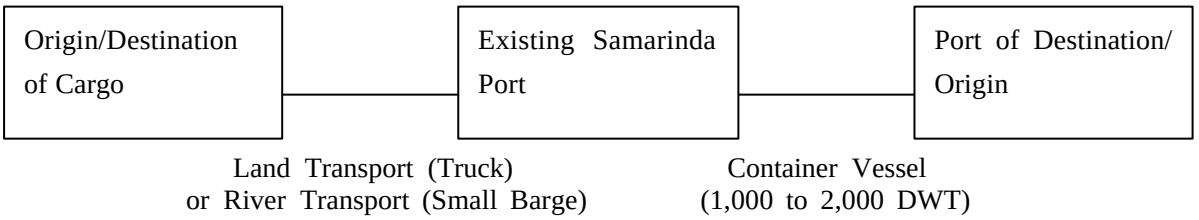
30.8.1 Vessel Calling Pattern

In order to define the roles of the development sites, the Study Team assumed the following vessel calling patterns for major cargo items. Barge transportation will continue to be prevalent for a large volume of bulk cargo like coal and log. On the other hand, general cargo vessels and container cargo vessels to/from Surabaya, tend to be deployed for the existing Samarinda Port to respond to frequent service demand.

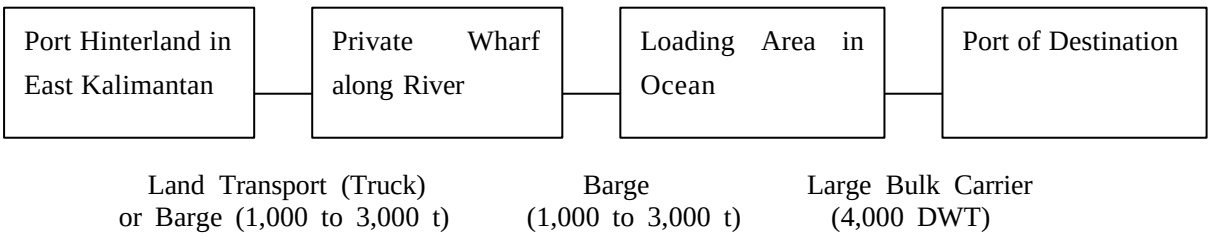
(1) Container



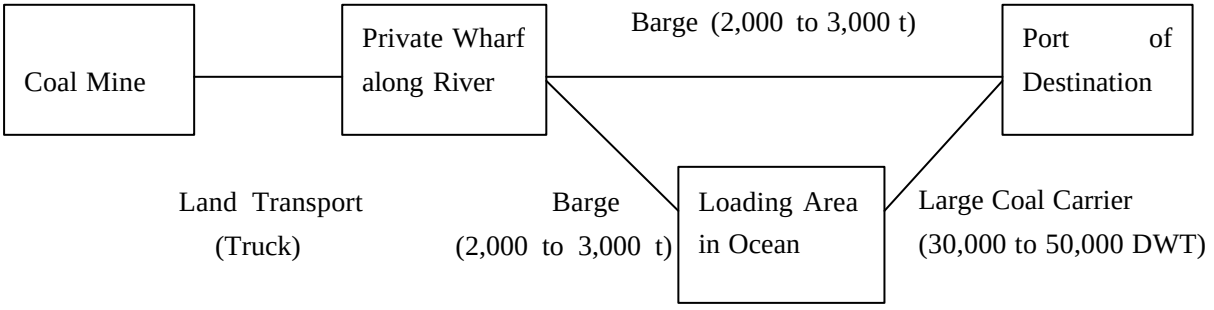
(2) General Cargo



(3) Timber Products



(4) Coal



30.8.2 Master Plan

(1) Master Plan for Samarinda consists of three major components, a port improvement plan at the existing Samarinda Port, a new container terminal plan at Palaran and a new passenger terminal plan at Selili.

(2) The existing Samarinda Port should be specialized in a general cargo terminal in the long-run. Since the general cargo demand will grow more than 1,069 thousand tons which require just 9 general cargo berths, the total 937 m wharves at Samarinda can be fully transformed into general cargo berths.

(3) The existing passenger berth will need much longer wharf, in accordance with future greater passenger vessel size. In addition, the passenger terminal should be separated from the cargo-handling terminal in order to ensure the safety of human traffic during embarkation/disembarkation at port.
Accordingly, the existing passenger terminal at Samarinda should be relocated to Selili before the existing passenger facilities are superannuated.

(4) A modern full container terminal should be constructed and operational without delay in order to catch up with rapid growing container cargo demand in the future. Since container terminals always require a huge amount of container-yards behind their wharves, there is no possibility to construct a new container terminal within the inextensible port at Samarinda.
The Study Team proposed a new full container terminal plan at Palaran, which is located 14 km downstream, and the former timber factory, now under mortgage to the Indonesian Bank Restructuring Agency.
There are 2 port development scenarios, depend on cargo handling productivity realized by the port management and operation organization. The first scenario is based on the 19 ha land acquisition will be possible, and also that a new port will be operational with 18 hours/day, 20 TEU/crane/hour. The other scenario is based on the condition that only 15 ha land acquisition will be possible, and also that a new port will be operational with 24 hours/day, 24 TEU/crane/hour.

The main components of the master plan are shown in Table 30.8.1 and Table 30.8.2 as for 6-berth scenario and 4-berth scenario, respectively.
The layout plan of a new container terminal is shown in Figure 30.8.1 and Figure 30.8.2 as for 6-berth scenario and 4-berth scenario, respectively.
The layout plan of a new passenger terminal is also shown in Figure 30.8.3.

Table 30.8.1 Master Plan for Samarinda (6-berth Scenario, 2025)

Facility	Dimensions
Additional Container Berths	6 Berths: 125m/berth, Draft 6m
Container Terminal	
Total Terminal Area	19 ha
Ground Slots	2,304 TEU
CFS	8,320 m^2
General Cargo Terminal	
Shed	6,800 m^2
Open Storage	31,300 m^2
Container Handling Equipment	
Gantry Crane	6
RTG	12
Yard Tractors	24
Container Handling Capacity	442,000 TEU/year
General Cargo Terminal	9 Berths, Draft 6m
General Cargo Handling Equipment	14 Mobile Cranes 45 Folk Lifts
Passenger Terminal	1 Berth: 120m, Draft 3.7m
Terminal Area	1 ha
Total Cost	Rp.931 billion

Table 30.8.2 Master Plan for Samarinda (4-Berth Scenario, 2025)

Facility	Dimensions
Additional Container Berths	4 Berths: 125m/berth, Draft 6m
Container Terminal	
Total Terminal Area	15 ha
Ground Slot	2,304 TEU
CFS	8,320 m^2
General Cargo Terminal	
Shed	6,800 m^2
Open Storage	31,300 m^2
Container Handling Equipment	
Gantry Crane	4
RTG	8
Yard Tractor	16
Container Handling Capacity	404,000 TEU/year
General Cargo Terminal	9 Berths, Draft 6m
General Cargo Handling Equipment	14 Mobile Cranes 45 Folk Lifts
Passenger Terminal	1 Berth: 120m, Draft 3.7m
Terminal Area	1 ha
Total Cost	Rp.705 billion

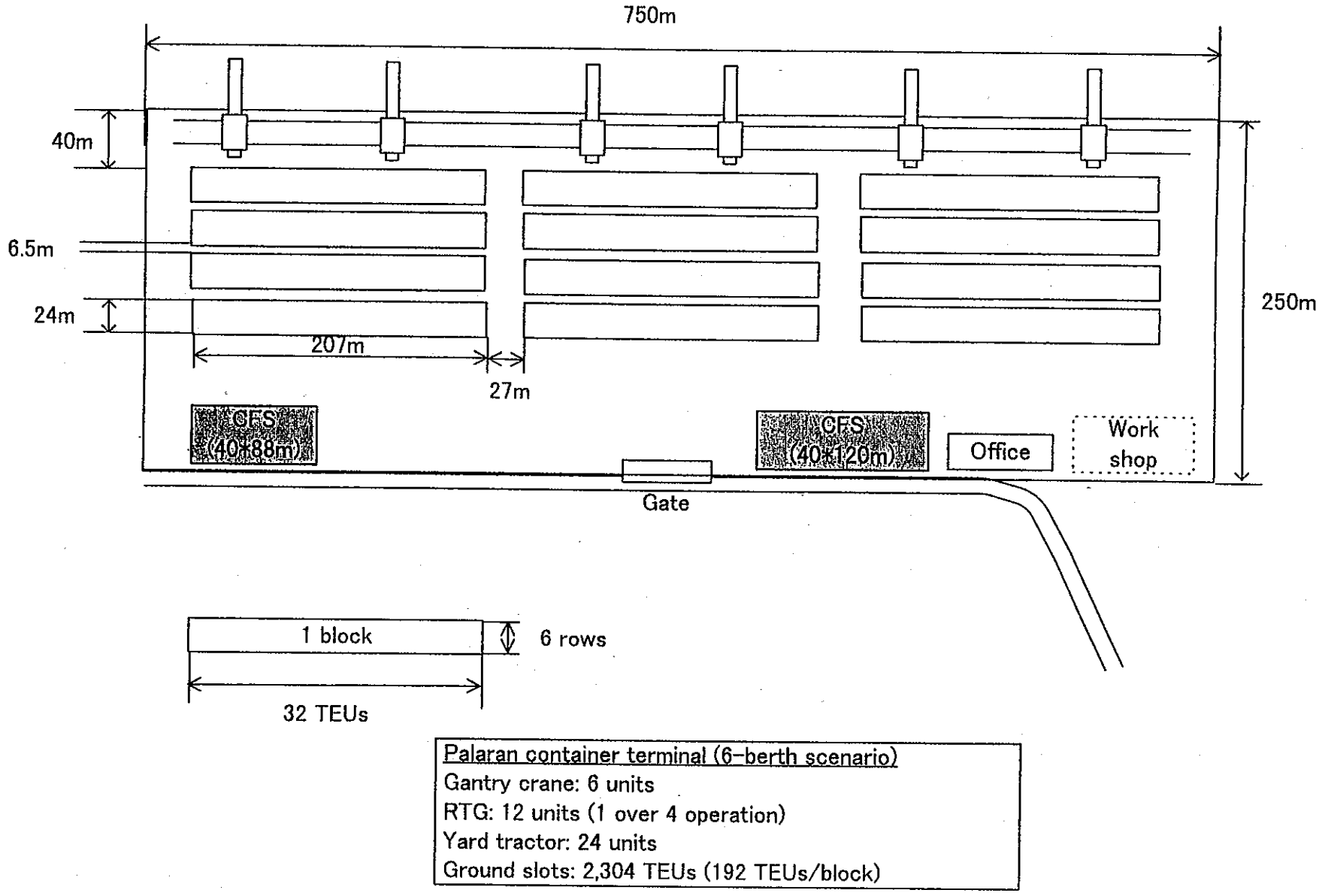
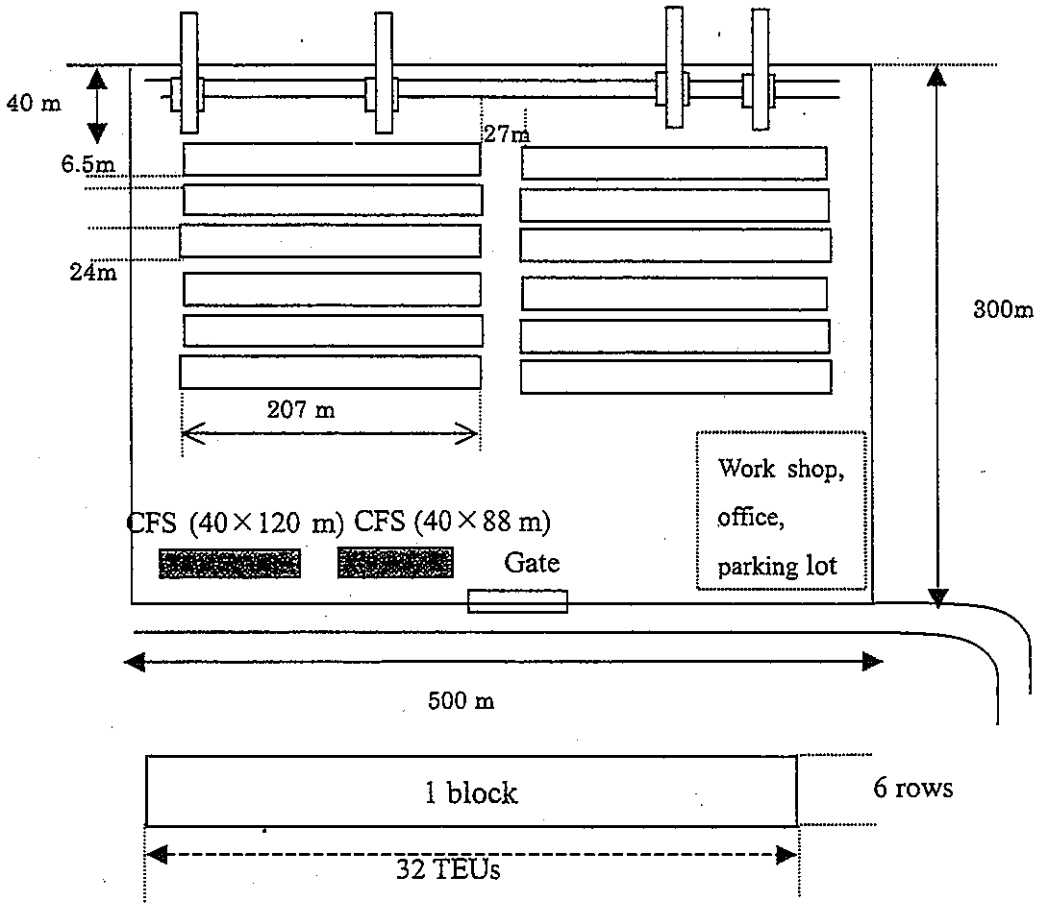


Figure 30.8.1 Layout Plan of Palaran Container Terminal in 2025 (6-berth scenario)

Figure 30.8.2 Layout Plan of Palaran Container Terminal in 2025 (4-berth scenario)



Palaran container terminal

- Gantry cranes: 4 units
- RTG: 8 units (1 over 4 operation)
- Yard tractors: 16 units
- Ground slots: 2,304 TEUs (192 TEUs/block)

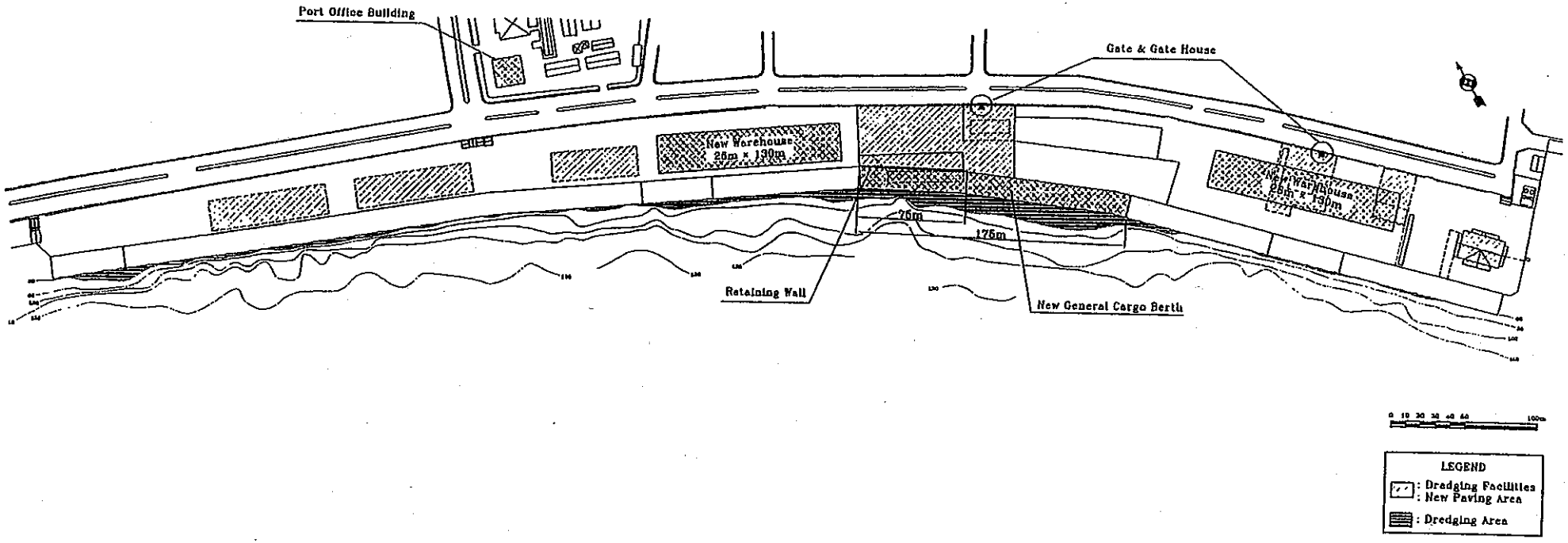


Figure 30.8.3 Layout Plan of Existing Samarinda Port (2025)

30.9 Administrative Framework

IPC IV Samarinda branch office serves as a port authority and manages Samarinda port. Samarinda ADPEL is responsible for the safe navigation along the Mahakam River. Port Working Area has to be established in Palaran area (Figure 30.9.1). ADPEL office, port related offices, and a passenger terminal are located in the existing Samarinda Port. The passenger terminal will need to be relocated to make room for cargo handling in the existing terminal. It is necessary to quickly relocate the ADPEL office and other buildings out of this narrow area. The existing 38 navigational aids are not enough for night navigation throughout the access channel. IPC IV will be responsible for the management of Palaran terminal. It is necessary to conduct training for IPC staff as well as for the private company staff.

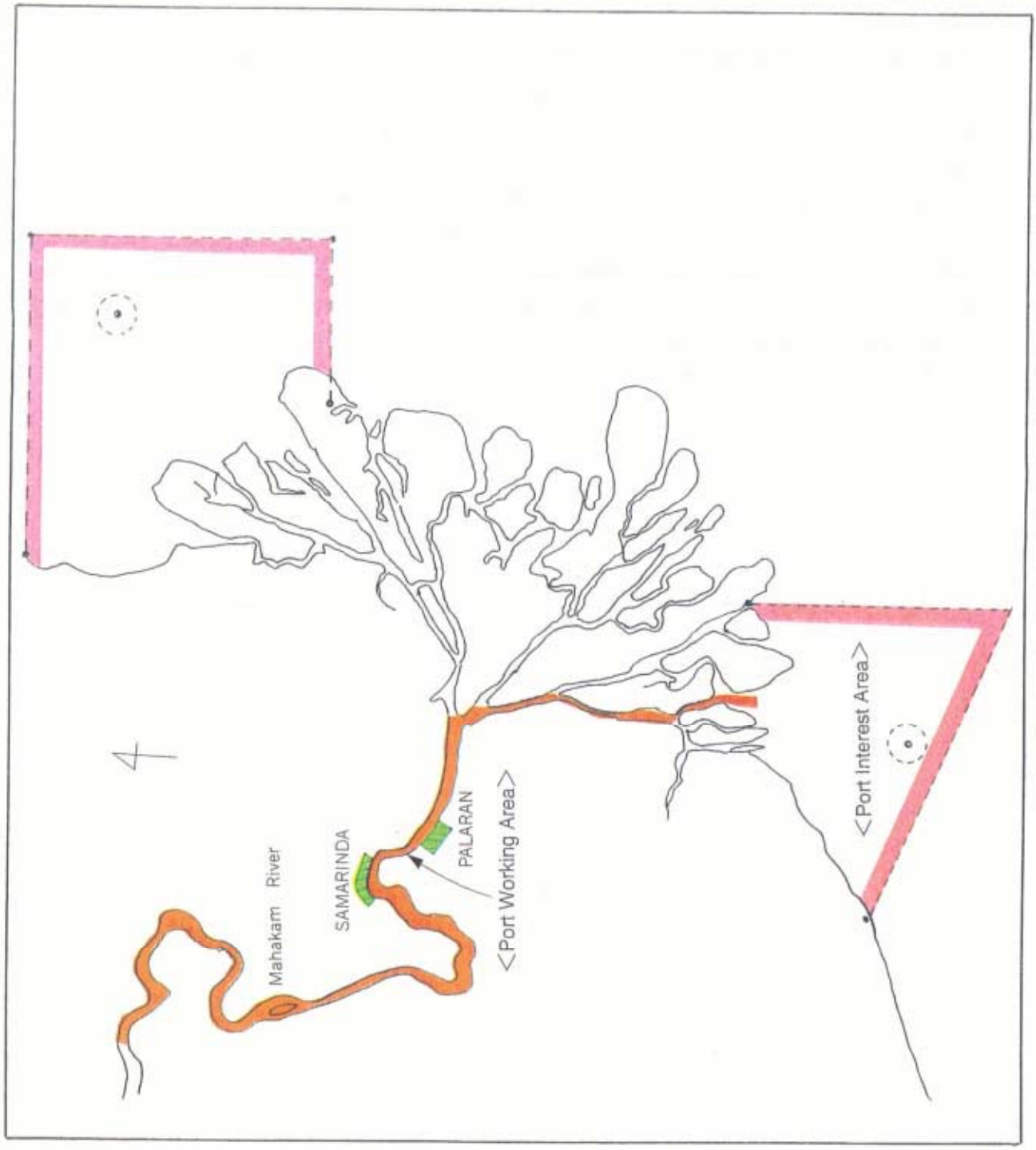


Figure 30.9.1 Port Working Area (DLKR) and Port Interest Area (DLKP) along the Mahakam River (PLAN)

30.10 Preliminary Engineering Studies

30.10.1 Preliminary Design of Port Facilities

(1) Design Vessel

Container Ship: 5,000 DWT, Overall Length: 110 m
Breadth: 15.7 m , Full loaded Draft: 5.5 m

Design water depth of the quay: 10% of keel clearance is considered: -6.5 m

(2) Design Conditions and Design Criteria

1) Codes and Standard
   - "Standard Design Criteria for Ports in Indonesia, 1984"
   - "Technical Standards for Port and Harbor Facilities in Japan, 1999"

2) Design Criteria

Table 30.10.1 General Design Criteria

		Samarinda	
	Palaran	Existing Port	Passenger Berth
Seismic coefficient	0.05	0.05	0.05
Load on berth	3t/m^2	3t/m^2	2t/m^2
Load on yard	4t/m^2	4t/m^2	2t/m^2
Truck	T-20	T-20	T-20
RTG on yard	Max.32t/wheel	-	-
Gantry Crane on berth	Max 45t/wheel	Crane 25t	-
Berth top elevation	+3.5	+3.5	+3.5
Berthing velocity of ship	15cm/sec	15cm/sec	15cm/sec
Subsoil condition	-	Silty sand	-
Assuming depth of hard strata	-40m~-15m	-38m	-38m

3) Tide Condition
Samarinda, Palaran : HWL = +2.65m , LWL = 0.0 m

(3) Layout

1) Palaran

The new container terminal development is planned at a Palaran site where a timber factory is currently located.

Table 30.10.2 Facilities and equipment for Palaran 6 berth case, (4 berth case)

Facility	Descriptions	Phase I	Phase II	Phase III	Phase IV
Container Berth	125m x 22m	3 unit (2)	1 unit (1)	1 unit (1)	1 unit
Retaining Wall	Sheet piles with Tie- rod	375m (250)	125m (125)	125m (125)	125m
Yard Pavement	T-20	79,400m^2 (68,500)	26,500 m^2 (24,000)	26,500 m^2 (24,000)	26,500 m^2
RTG Lane	1.5m width, RC beam	4,950 m^2 (4950)	1,650m^2 (2475)	1,650m^2 (2475)	1,650 m^2
Container sleeper	1.5m width, RC beam	6,425 m^2 (6425)	2,142m^2 (3213)	2,142m^2 (3213)	2,142 m^2
CFS	100m x 40m	4,160 m^2 (3,520)	4,160m^2 (4800)	-	-
Workshop	R.C	1,200 m^2 (,,)	-	-	-
Terminal Office	R.C	800 m^2 (,,)	-	-	-
Access Road	Terminal Access	30,500 m^2 (,,)	-	(368 m^2)	(368 m^2)
Utilities	Power, Water, Drainage,etc.	L.S (,,)	L.S (,,)	L.S (,,)	L.S (,,)
Equipment	Capacity	Phase I	Phase II	Phase III	Phase IV
Quay Gantry Crane	12m.span, 22m reach,	3 units (2 units)	1unit (1unit)	1unit (1unit)	1unit
RTG	6 lanes, 1 over 4	6 units (4 units)	2unit (2unit)	2unit (2unit)	2 units
Yard Tractors	20" , 40"	12 units (8 units)	4unit (4unit)	4unit (4unit)	4 sets

2) Samarinda Existing Port (See Fig 30.10.3)

A new 175 m long general cargo berth is proposed between the existing berths at Samarinda Port.

The existing passenger terminal will be transferred to the southern area of the existing port.

Table 30.10.3 Facilities and equipment for Samarinda Port

Facility	Descriptions	Existing Port	Passenger Terminal
Cargo Berth	175m x 15m	1 unit	-
Retaining Wall	Sheet piles with Tie- rod	75m	100m
Yard Pavement	T-20	10,500m^2	-
Warehouse	130m x 26m	2 units	-
Office	R.C (3F)	1,200 m^2	
Passenger Berth	Platform 40m, Trestle 30m	-	1 unit
Mooring Dolphin	50 t (5m x 5m)	-	2 units
Passenger Building	20m x 80m (2F)	-	3,200 m^2
Parking Pavement	T-16		7,400 m^2
Utilities	Power, Water, Drainage, Sewerage	L.S	L.S
Equipment	Capacity	Existing Port	
		Phase I	Phase II
Mobile Crane	25 t	3 units	3unit
Forklift	7 t Diesel	10 units	10 units

(4) Design of Port Facilities

1) Container Berth for Palaran and General Cargo Berth for existing Port

The container berth for Plaran is designed in the RC deck structure supported by steel pipe piles.

2) Pavement (Road, Container yard and General cargo open storage)
   - Container storage areas and general cargo open storage: rectangulat interlocking blocks.
   - RTG runway beams: RC slab
   - Container Sleeper: RC sleeper
   - Roads and Other area of Container Terminal: cement concrete

3) Buildings

   The proposed buildings are basically planned as RC column structure.

30.10.2 Cost Estimation

Assumptions for Cost Estimation are as follows:

1) Basic Price and Exchange Rates

   The basic prices are as of 2001 and the foreign exchange rates of:

   1 US$ = 9,500 Rupiah (Rp) = 118 Yen

2) Maintenance Cost

   - 2 % of the facility construction cost per annum.
   - 3% of the equipment cost per annum.
   - Maintenance dredging unit cost = Rp 13,000/m^3

3) Construction Cost and Procurement Cost

   - 10 % to 15 % of construction cost for the engineering fee
   - 3% of equipment cost for engineering fee.
   - 8 % of construction cost for physical contingency
   - 10 % of construction cost for VAT

4) Project Cost

Table 30.10.4 Summary of Project Cost for Samarinda (Unit in Million Rp.)

	Civil Work		Equipment		Total	
	Foreign	Local	Foreign	Local	Foreign	Local
Samarinda	73,689	38,432	24,742	2,904	98,431	41,336
Palaran: 4-Berth Case	175,965	94,966	236,316	30,165	412,281	125,131
Palaran: 6-Berth Case	233,945	125,399	354,475	45,246	588,420	170,645
Land Acquisition						
4-Berth Case						28,200
6-Berth Case						32,040
Total of Samarinda						
4-Berth Case	249,654	133,398	261,058	33,069	510,712	194,667
6-Berth Case	307,634	163,831	379,217	48,150	686,851	244,021

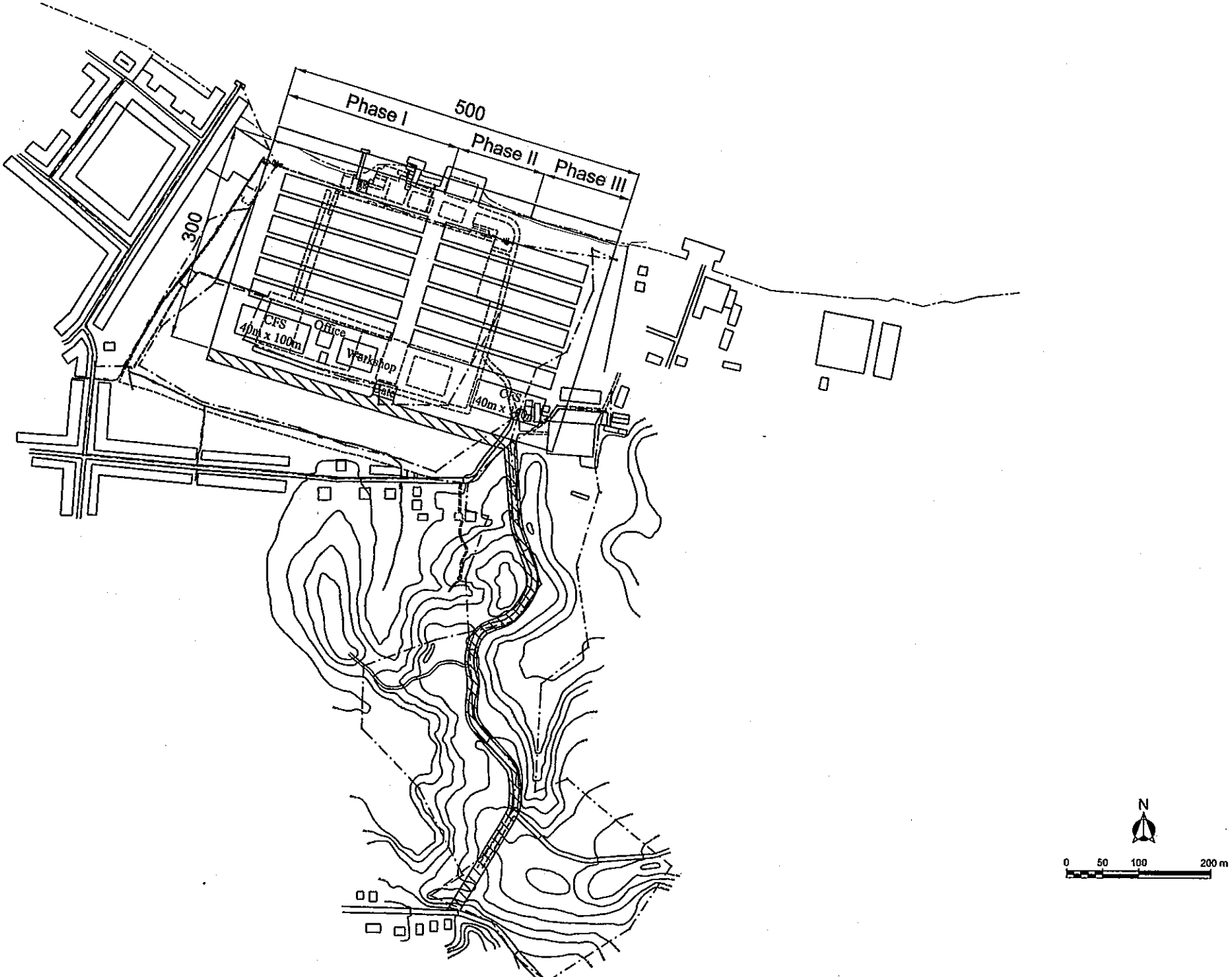


Figure 30.10.1 Master Plan of Palaran (1)

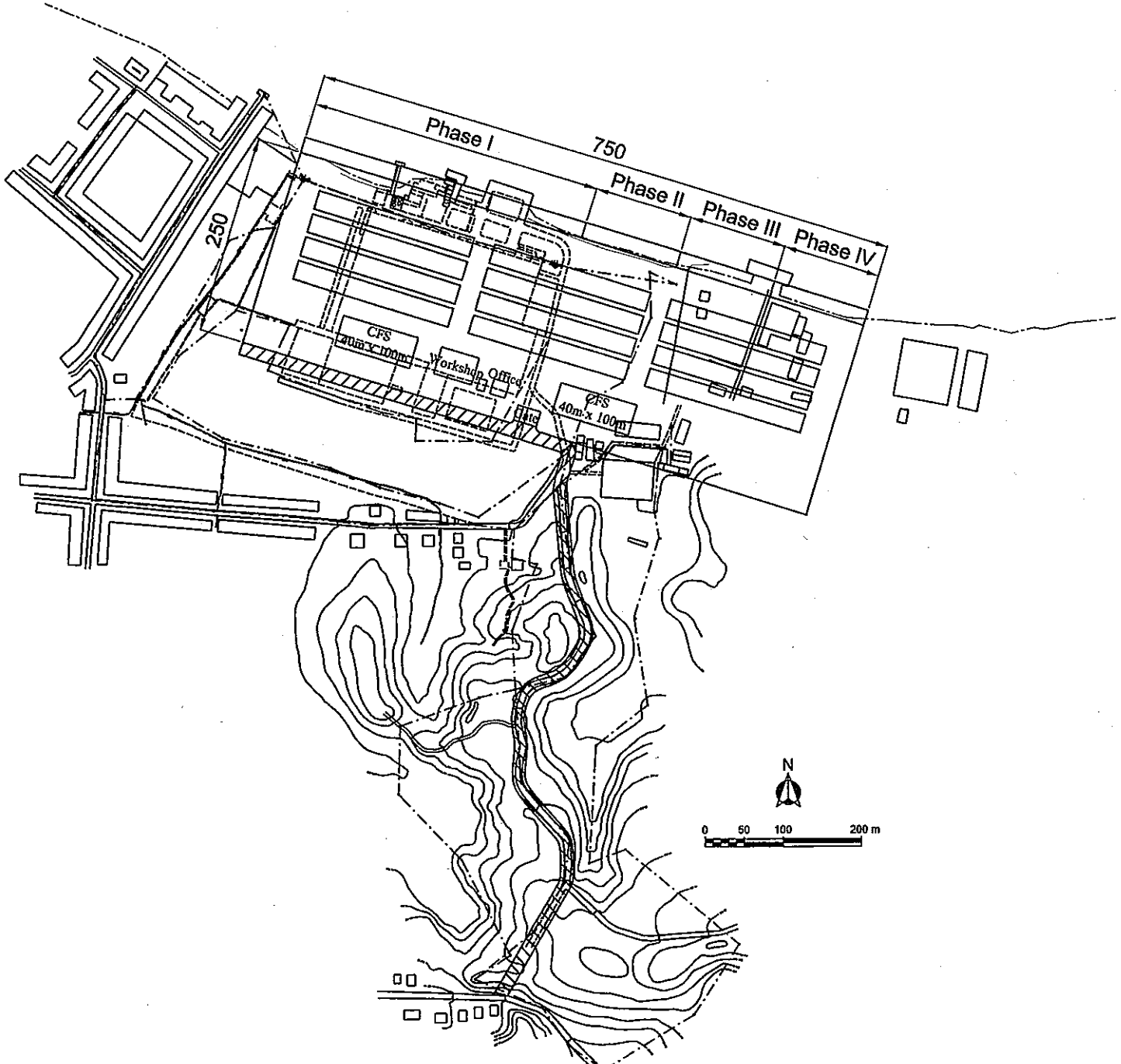


Figure 30.10.2 Master Plan of Palaran (2)

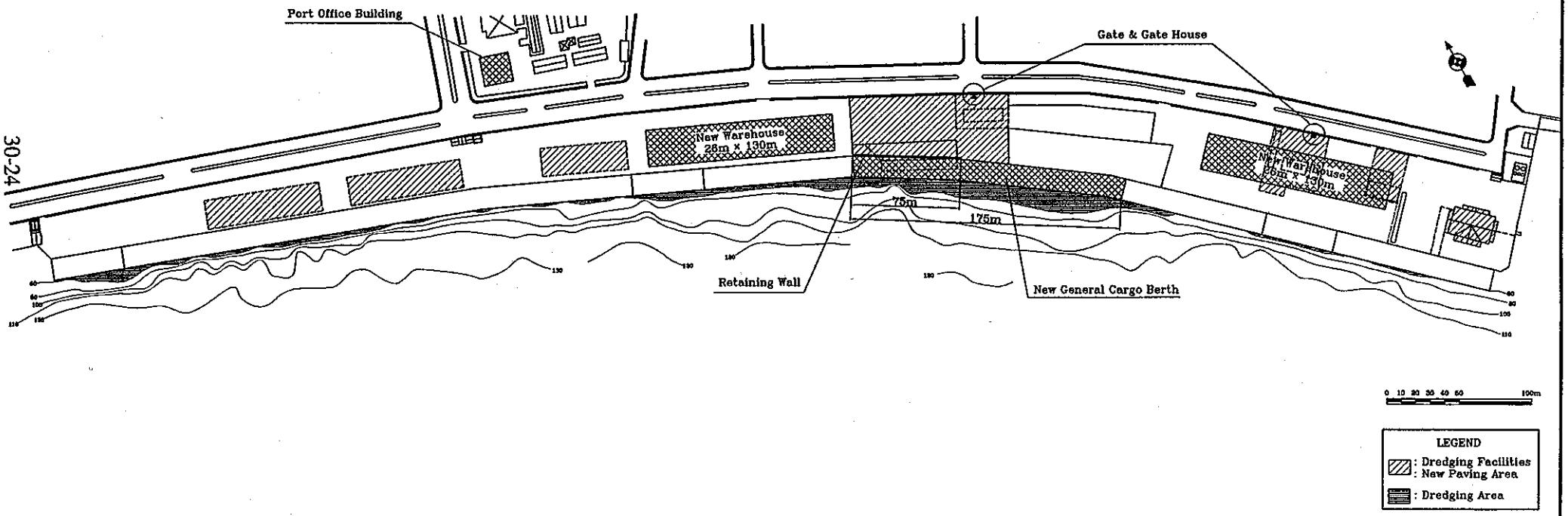


Figure 30.10.3 Master Plan of Samarinda

30.11 Phased Planning

The measures to be taken at the existing Samarinda Port and the new container terminal at Palaran up to the year 2025 are summarized below (Table 30.11.1 to Table 30.11.3). It can deal with the projected volume of general cargo with these measures.

Table 30.11.1 Milestone at the Existing Terminal

Year	Milestone	Procurement	Construction
2006		3 Mobile Cranes, 10 Forklifts	
2007	Container Handling moved to Palaran The Existing Terminal dedicated to General Cargo (7 Wharves)		
2010		3 Mobile Cranes, 10 Forklifts	1 General Cargo Wharf, Replacement of Existing Sheds with New Sheds
2011	2 more Wharves become operational		
2018			1 Passenger Wharf, Demolition of Existing Passenger Terminal Building
2019	New Passenger Terminal becomes operational		

Table 30.11.2 Milestone at Palaran (6-berth Scenario)

Year	Milestone	Procurement	Construction
2006		3 Gantries, 6 RTG, 12 Yard Tractors	3 Container Wharves, CFS, Access Road
2007	Container Terminal becomes operational (3 Wharves)		
2010		1 Gantry, 2 RTG, 4 Yard Tractors	1 Container Wharf, CFS
2011	1 more Wharf becomes operational		
2016		1 gantry, 2 RTG, 4 Yard Tractors	1 Container Wharf
2017	1 more Wharf become operational		
2022		1 Gantry, 2 RTG, 4 Tractors	1 Container Wharf
2023	1 more Wharf become operational		

Table 30.11.3 Milestone at Palaran (4-berth Scenario)

Year	Milestone	Procurement	Construction
2006		2 Gantry, 4 RTG, 8 Yard Tractors	2 Container Wharves, CFS, Access Road
2007	Container Terminal becomes operational (2 Wharves)		
2010		1 Gantry, 2 RTG, 4 Tractors	1 Container Wharf, CFS
2011	1 more Wharf become operational		
2018		1 Gantry, 2 RTG, 4 Tractors	1 Container Wharf
2019	1 more Wharf become operational		

30.12 Capacity Evaluation

30.12.1 Simulation Model

Two scenarios were examined for the Short Term Plan (target year 2007) and the Master Plan (target year 2025) of Samarinda. The purpose of this chapter is to carry out the "Vessel Traffic Simulation" for both scenarios and to examine their results.
A numerical simulation model "WITNESS 2000" was employed to evaluate whether the port capacity and the channel capacity would be sufficient to cope with the increasing cargo and vessel traffic throughout the planning period of this study.

30.12.2 Capacity Evaluation of Samarinda Short Term Plan (2007)

The average BOR of the container berths is 47.7% (Case 1) and 47.0% (Case 2), and do not differ very much from one another.
Case 2 requires a waiting time of 128 minutes, considerably shorter than the 181 minutes in Case 1.

30.12.3 Capacity Evaluation of Samarinda Master Plan (2025)

The average BOR of the container berths is 55.6% (Case 1) and 57.6% (case 2), and do not differ very much from one another. BOR in both cases can be judged reasonable.
Regarding the average berth waiting time, Case 2 requires a waiting time of 88 minutes, slightly shorter than the 117 minutes of Case 1. With a waiting time of less than 2 hours, both cases can be considered reasonable.

30.13 The Economics of Port Master Plans at Samarinda

This section looks at the proposed river port development at Palaran and development of the existing port. Of the two main options (4-berth or 6-berth container facility at Palaran), there seems little additional benefit provided by the 6-berth option.

The study establishes the preliminary EIRR and NPV of these Master Plans.

The economic/shadow pricing of the financial capital costs established in another part of the study are prepared along with maintenance and operating costs.

The project life is 33 years from the first expenditure providing some 30 years of benefits, although after 20 years the discounted costs and benefits are small.

Benefits are based on less waiting and berth time for larger ships and avoided land transport costs if the project is not built.

Some additional costs are incurred because Palaran is 20 km from Samarinda city.

It is estimated that the 4-berth option generates an EIRR of 21.8 % and the 6-berth scenario 17.2 %.

Both scenarios are viable and that is partly due to rapidly expanding container traffic and predicted high berth congestion if there is no port development. The project would be an important contributor to the economic development of the region.

30.14 Financial Analysis

30.14.1 Objective and Methodology of Financial Analysis

(1) Objective

The purpose of the financial analysis is to evaluate the financial feasibility of the project (The project means the long-term development plan at Palaran in this section.).

(2) Methodology

The viability of the project is analyzed, using the financial internal rate of return (FIRR) by means of the discount cash flow method.

(3) Assumption for Financial Analysis

Preconditions of financial analysis are shown in Table 30.14.1.

Table 30.14.1 Preconditions of Financial Analysis

Base Year	Year 2001
Project Life	30 years
Revenue	Calculation based on port tariff 2001 (Also raised tariff in 2018) and forecast of cargo volume
Expenditure	
・Investment	Initial investment cost includes tax.
・Re-investment	Gantry crane 25 years, RTG 20 years, Mobile crane 15 years. Forklift and tractor 10 years each.
・Maintenance and Repair	Infrastructure: 2.0% of original construction cost. Equipment: 3.0% of original purchasing cost
・Personnel and Administration	Calculation based on personnel plan and the existing scale of payment.
・Depreciation	Calculation by means of the straight line method, based on IPC4 standard.
・Tax	Income tax and deemed dividend tax.
Fund Raising	
・Foreign Loan	Loan period: 30 years, Interest rate: 1.0%, Grace period: 10 years, Proportion: 85 % of initial investment cost.
・Domestic Loan	Loan period: 10 years, Interest rate: 18.0%, Proportion: 15% of initial investment cost

30.14.2 Evaluation of the Project

(1) Viability

FIRR (Financial Internal Rate of Return) of the project is 7.7% in 6-berth scenario, and 10.9% in 4-berth scenario.

30.14.3 Sensitivity Analysis

Sensitivity analysis was carried out to examine the impact of unexpected future changes such as cargo volume, construction cost, and port revenues. The following cases were envisioned.

Case 1: Investment costs increase by 10%.
Case 2: Port revenues decrease by 10%.
Case 3: Investment costs increase by 10%, and port revenues decrease by 10%.

Results of the sensitivity analysis are shown in Table 32.6.2. In all cases, FIRR exceeds the weighted average interest rate of the funds (3.55%).

Table 30.14.2 Results of Sensitivity Analysis

Case	Palaran 6-berth Case	Palaran 4-berth Case
Original Case	7.66%	10.89%
Case 1	6.39%	9.60%
Case 2	6.26%	9.46%
Case 3	4.99%	8.20%

30.14.4 Conclusion

Judging from the above analysis, the project can be regarded as financially feasible.

31. INITIAL ENVIRONMENTAL EXAMINATION

31.1 EIA Criteria of port development in Indonesia

EIA is required for a development projects larger than a certain scale by the environmental laws of Indonesia and method and regulations are stipulated in EIA Guideline of Indonesia (1999) (see Table 31.1.1).

Table 31.1.1 Criteria of EIA for Port Development Project

Project type	Project description	Criteria of development project requires EIA
Port development project	Berthing facility	Facility more than 200m in length or 6,000m^2 in area
	Breakwater	More than 200m in length
	Development area	More than 5 ha in area
	Mooring buoy	More than 10,000DWT
Dredging	Initial dredging	Dredged soil volume more than 250,000m^3
	Maintenance dredging	Dredged soil volume more than 500,000m^3
Reclamation		More than 25 ha in area or dredged soil volume 500,000m^3
Soil dumping		Dumped soil volume more than 250,000m^3

(Source: Revised Environmental Impact Assessment Procedure in Indonesia)

31.2 Results of the IEE

The Environmental Impact Assessment is required for the development activities of Samarinda port and Palaran.

The basis of the requirement of EIA is as follows:

1) Total lengths of the new berths are longer than the EIA criteria of 200m.
2) The construction of Samarinda port container terminal of 15 ha exceeds the EIA requirement criteria of 5 ha.
3) The dredged soil volume (initial dredging volume 1.6 million m^3, maintenance dredging volume 1.6 million m^3) in Mahakam river exceeds the EIA requirement criteria (initial dredging volume 0.25 million m^3, maintenance dredging volume 0.5 million m^3).
4) Resettlement is expected.
5) The number of vehicles in traffic volume is anticipated to increase on the access road to Palaran.
6) Water pollution generated from the coal terminal in Talang Duku is anticipated. In addition, soil erosion, air pollution, soil contamination, noise and vibration are expected in construction and operation phase according to the environmental scoping.

Regarding Category A items “Resettlement” (the problems of the resettlement of the

inhabitants), the existing timber factory and the consequent compensation for land acquisition of new port development project in Palaran are expected. Detail study will be carried out in the next stage.

Environmental impacts expected particularly in the construction phase (such as “air pollution”, “water pollution”, “noise and vibration”) can be dealt with by adopting proper construction methods. Such environmental conscious work methods are considered not to need additional construction cost.

Category “B” items are “Traffic”, “Waste”, “Fauna and Flora”, “Water Pollution”, “Air Pollution”, “Soil Contamination”, and “Noise and Vibration”. These are the items that are considered to have some affect on the environment.

Category “B” and “C” items will be clarified their impacts and magnitude in the next stage of the study and survey.

The Environmental Management Plan (RKL) and the Environmental Monitoring Plan (RPL) will be formulated as one of the procedures of Environmental Impact Assessment (EIA). The appropriate environmental management, implementation of continuous observation and monitoring of the environmental change will be recommended by RKL and RPL.

32. SHORT-TERM PLAN OF SAMARINDA

32.1 Project Description

This short-term plan is made up of the projects urgently needed in Samarinda Port in response to the needs of the regional economy. The master plan proposes that a major part of container handling activity at port be transferred from the existing port of Samarinda to Palaran after Palaran becomes fully operational. Accordingly, urgent projects are proposed only in Palaran.

The layout plan for the short-term plan is shown in Figure 32.1.1 (6-berth Scenario) and Figure 32.1.2 (4-berth Scenario). Main components of the plan are shown in Table 32.1.1. Three berths for container need to be created in case of 6-berth scenario, and two berths for container need to be created in case of 4-berth scenario.

Table 32.1.1 Short-term Plan for Palaran

Facility	Dimensions in Case of 6-Berth Scenario	Dimensions in Case of 4-Berth Scenario
New container Berths	3 Berths, 125m/Berth, Draft: 6m	2 Berths, 125m/Berth, Draft: 6m
Container Terminal: Total Terminal Area Ground Slot CFS	 9.4 ha 913 TEUs 3,520 m2 (40m x 88m)	 7.5 ha 913 TEUs 3,520 m2 (40m x 88m)
Container Handling Equipment: Gantry Crane RTG Yard Tractor	 3 6 12	 2 4 8
Container Handling Capacity	173,500 TEU	168,000 TEU
Access Channel	Width: 80 m, Depth: 6 m	Width: 80 m, Depth: 6 m
Total Cost	Rp. 417 billion	Rp. 316 billion

The measures to be taken at Palaran up to the short-term target year 2007 are summarized below (Table 32.1.2 and Table 32.1.3). Palaran terminal can deal with the projected volume of container cargo with these measures.

Table 32.1.2 Milestone at Palaran (6-berth Scenario)

Year	Milestone	Procurement	Construction
2004			1 Container Wharf
2005			1 Container Wharf
2006		3 Gantry Cranes, 6 RTGs, 12 Yard Tractors	1 Container Wharf, CFS, Access Road
2007	New container terminal becomes operational at Palaran.		

Table 32.1.3 Milestone at Palaran (4-berth Scenario)

Year	Milestone	Procurement	Construction
2005			1 Container Wharf
2006		2 Gantry Cranes, 4 RTGs, 8 Yard Tractors	1 Container Wharf, CFS, Access Road
2007	New container terminal becomes operational at Palaran. The existing port of Samarinda dedicated to general cargo (7 wharves).		

Regarding the access channel, the Team proposed the following provisional condition of the access channel, since the number of calling vessels at Palaran will be relatively small at early stage.

- Width : 80 m
- Depth : 6 m

32.2 Engineering Design and Cost Estimate for Short Term Plan of Samarinda

32.2.1 Design Conditions

(1) Proposed Vessel

Container Ship : 5,000DWT, Length Overall :110m

Breadth of Ship : 15.7m, Full loaded Draft : 5.5m

Required depth of the berth : 6.5m

(2) Design Codes and Standard

- Standard Design Criteria for Ports in Indonesia, 1984
- Technical Standards for Port and Harbour Facilities in Japan, 1999

(3) Design Criteria

Table 32.2.1 General Design Criteria

Description	Palaran
	Container Berth
Seismic coefficient	0.05
Load on berth	3t/m^2
Load on yard	4t/m^2
Truck	T-20
RTG on yard	Max.32t/wheel
Gantry Crane on berth	Max 45t/wheel
Berth top elevation	+3.5
Berthing velocity of ship	15cm/sec
Subsoil condition	Silty sand
Assuming depth of hard strata	-40m~-25m

(4) Tide Condition

Palaran: HWL = +2.65m, LWL = +-0.0m

32.2.2 Layout of Short Term Development Plan

The new container terminal is planned to develop in Palaran where a timber factory is now located. This development is divided into two alternative scenarios: 4-berths scenario and 6-berths (refer to Figures 32.2.1 and 32.2.2).

In the short term development plan, two (2) container berths having 125m length each with related facilities are constructed in the 4 berths scenario, three (3) container berths having 125m length each with related facilities are constructed in the 6-berths scenario.

The container berth is 22m width to secure the 12 m rail span of the gantry crane

32.2.3 Design of port Facilities

(1) Berthing Facilities (see Fig 32.2.3)

The container berth is planned the RC deck structure supported by the steel pipe piles with tip elevation varied from DL –40 m to –17.5 m.

As for the accessories, 35-ton bollards, cellular type 800H rubber fenders are recommended.

(2) Dredging and Reclamation

Structural dredging work will be bone by using clamshell buckets on barges up to DL –6.5m along the berth Ground elevation of the existing timber factory yard is approximately +3.5m, which is almost the same height as the planned container yard. Reclamation work is therefore, not required for the container yard except for the area behind the berth.

Due to the site situation, settlement of the proposed container yard will be minimal. Assuming 2 tons/m^2 additional yard load, the settlement of the yard surface is anticipated to be 15 to 25 cm in 20 years.

(3) Pavement (Road, Container yard)

Container storage areas and general cargo open storage :Interlocking blocks
RTG runway beam (RTG Lane): RC beam
Container Sleeper: RC
Roads and Other area of Container Terminal: Cement concrete

(4) Access Road

The access road to the terminal from the existing provincial road is included in this project. The road is planned to make slope 5 % maximum and have 2 lanes with a walkway, for each direction.

(5) Buildings

Table 32.2.2 Summary of Buildings

Building	Floor Area (m^2)	Number of Peoples	Foundation Structure	Column Structure	Stories
Office Building	800	50	RC Piles	R.C	2
Maintenance Shop	1,750	10	RC Piles	R.C	1
Main Gate House	6–Lanes	10	RC Base	R.C	1
CFS (6-berth)	3,520 (4,000)	10	RC Piles	R.C	1
Canteen & Workers Room	150	30	RC Base	R.C	1

(6) Utilities

- Drainage System
- Power Supply System
  Emergency generator (1000 KVA) is considered for the site.
- Water Supply
  As the available existing fresh water supply service is not sufficient at Palaran site, a fresh water plant is to be provided by the deep well or river water.
- Sewerage System and Other Utilities

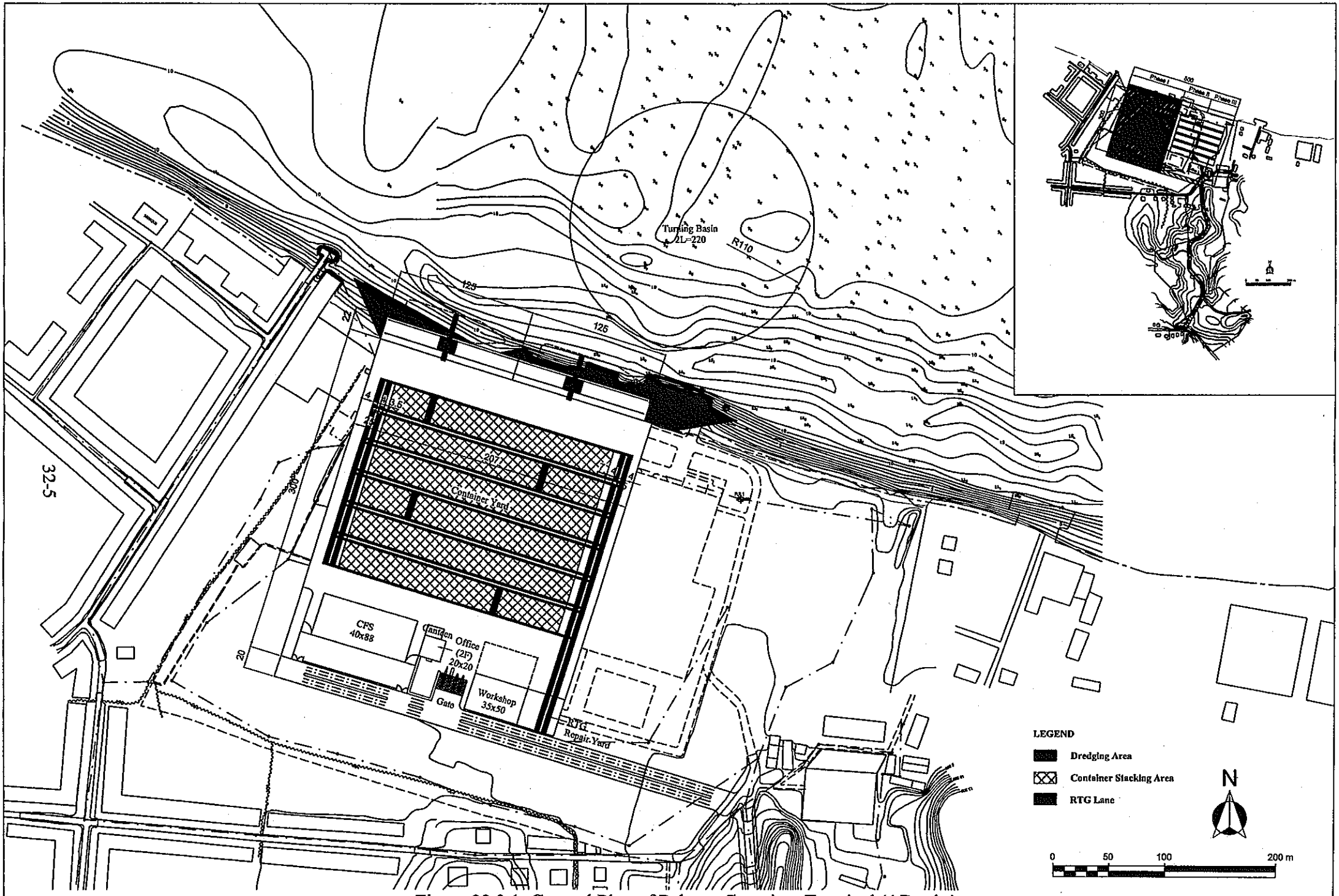


Figure 32.2.1 General Plan of Palaran Container Terminal (4 Berths)

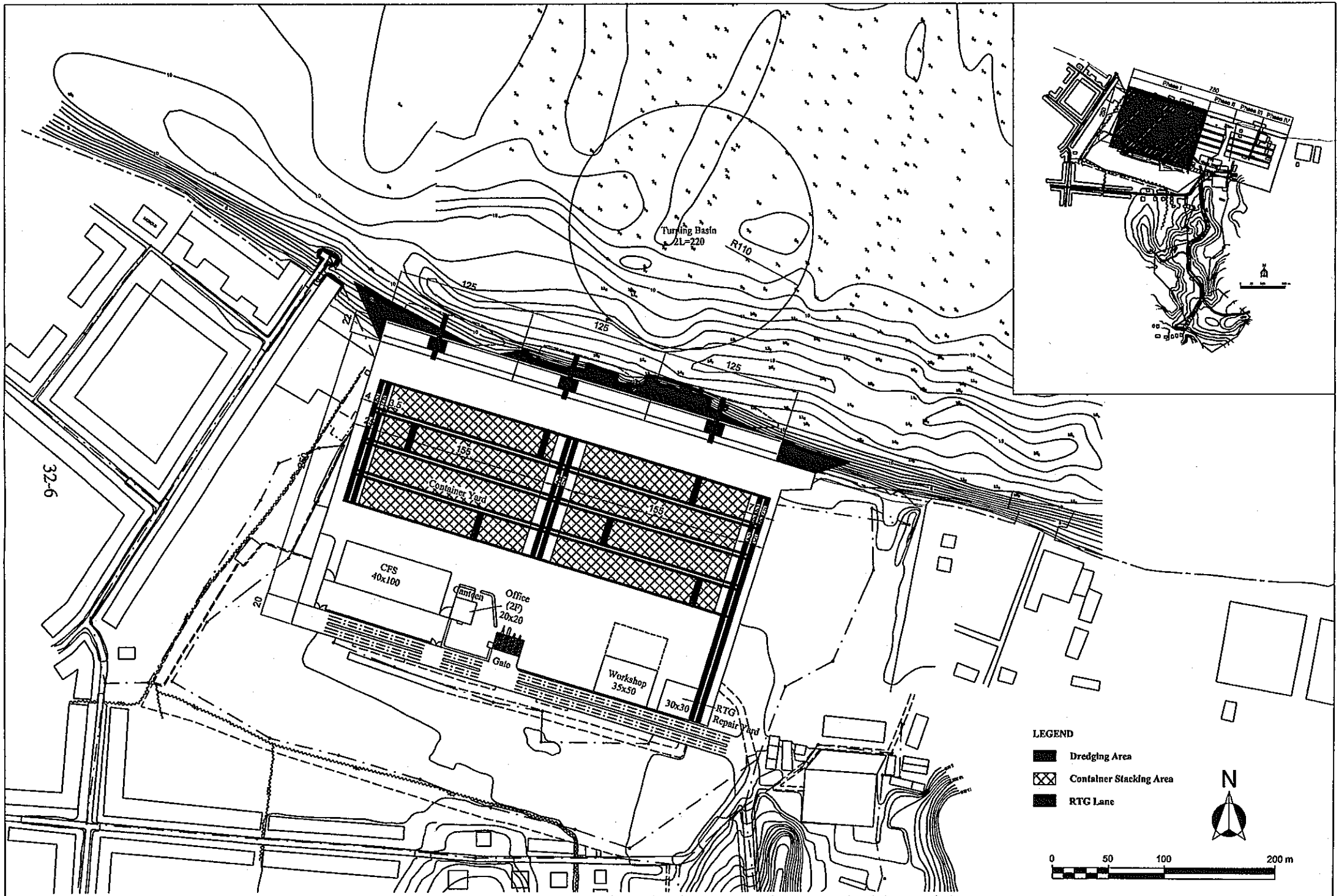


Figure 32.2.2 General Plan of Palaran Container Terminal (6 Berths)

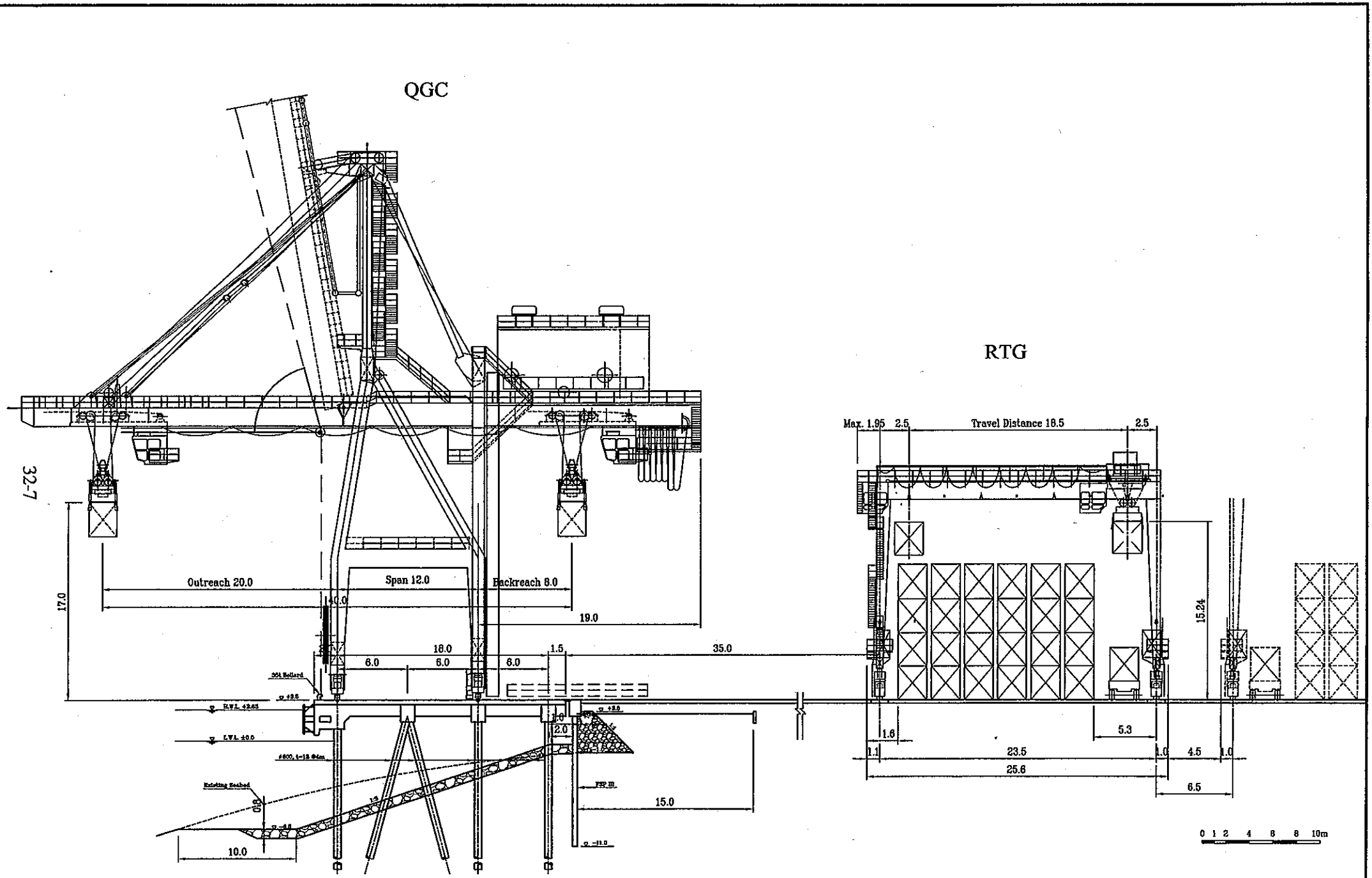


Figure 32.2.3 Palaran Container Terminal

32.2.4 Scope of Works

The scope of works for the general cargo terminal and the container terminal is summarized in Table 32.2.3.

Table 32.2.3 Scope of Works for Short Term Development in Samarinda

4 Berths Scenario					6 Berths Scenario				
Construction			unit	Quantity	Construction			Unit	Quantity
(1)	Mobilization and Demobilization		L.S	1	(1)	Mobilization and Demobilization		L.S	1
(2)	Dredging & Reclamation				(2)	Dredging & Reclamation			
	1)	Dredging	m3	11,700		1)	Dredging	m3	21,000
	2)	Reclamation	m3	4,500		2)	Reclamation	m3	9,300
(3)	Berth Construction				(3)	Berth Construction			
	1)	Steel Pipe Piling Work (D=600)	m	12,300		1)	Steel Pipe Piling Work (D=600	m	16,200
		Earth auger	point	0			Earth auger	point	0
	2)	Concrete Deck				2)	Concrete Deck		
		Concrete Placing	m3	4,125			Concrete Placing	m3	6,000
		Re-bar Work	ton	454			Re-bar Work	ton	660
	3)	Retaining Wall				3)	Retaining Wall		
		Sheet Piling Work	m	10,150			Sheet Piling Work	m	15,450
		Concrete Coping Work	m3	346			Concrete Coping Work	m3	490
		Tie-rod & Anchor Block	No.	181			Tie-rod & Anchor Block	No.	490
		Backfill Stone	m3	3,250			Backfill Stone	m3	4,900
		Backfill	m3	4,500			Backfill	m3	6,500
	4)	Slope Protection	m2	7,600		4)	Slope Protection	m2	11,400
	5)	Wharf Fittings				5)	Wharf Fittings		
		Fender & Bollard	set	18			Fender & Bollard	set	32
		Crane Rail Fittings	m	500			Crane Rail Fittings	m	750
	6)	Yard Preparation	L.S	1		6)	Yard Preparation	L.S	1
(4)	Yard Pavement				(4)	Yard Pavement			
	1)	Block Paving	m2	27,500		1)	Block Paving	m2	27,500
	2)	RTG Lane	m2	4,950		2)	RTG Lane	m2	4,950
	3)	Container Sleeper	m2	6,425		3)	Container Sleeper	m2	6,425
	4)	Concrete Paving	m2	41,000		4)	Concrete Paving	m2	51,950
(5)	Access Road				(5)	Access Road			
	1)	Cutting & Filling & Grading	L.S	1		1)	Cutting & Filling & Grading	L.S	1
	2)	Concrete Paving	m2	30,500		2)	Concrete Paving	m2	30,500
	3)	Utilities	L.S	1		3)	Utilities	L.S	1
(6)	Buildings				(6)	Buildings			
	1)	Demolishing Existing Facilities	L.S	1		1)	Demolishing Existing Facilities	L.S	1
	2)	CFS (1 Unit)	m2	3,520		2)	CFS (1 Unit)	m2	4,160
	3)	Gate	m2	500		3)	Gate	m2	500
	4)	Terminal Office Building	m2	800		4)	Terminal Office Building	m2	800
	5)	Work Shop	m2	1,750		5)	Work Shop	m2	1,750
	6)	Canteen	m2	150		6)	Canteen	m2	150
(7)	Yard Fence		m	1,100	(7)	Yard Fence		m	1,000
(8)	Drainage System		L.S	1	(8)	Drainage System		L.S	1
(9)	Power Supply & Yard Lighting		L.S	1	(9)	Power Supply & Yard Lighting		L.S	1
(10)	Water Supply System		L.S	1	(10)	Water Supply System		L.S	1
(11)	Sewerage System		L.S	1	(11)	Sewerage System		L.S	1
(12)	Other Utilities		L.S	1	(12)	Other Utilities		L.S	1
Equipment					Equipment				
	1)	Gantry Crane	Unit	2		1)	Gantry Crane	Unit	3
	2)	RTG	Unit	4		2)	RTG	Unit	6
	3)	Tractor & Trailer	Unit	8		3)	Tractor & Trailer	Unit	12

32.2.5 Cost Estimation

Assumptions for Cost Estimation are as follows.

(1) Basic Price and Exchange Rates

The basic prices are as of 2001 and the foreign exchange rates of:

1 US$ = 9,500 Rupiah (Rp) = 118 Yen

(2) Maintenance Cost

- 2 % of the facility construction cost per annum.

- 3 % of the equipment cost per annum.
- Maintenance dredging unit cost = Rp 13,000/m^3

(3) Construction Cost and Procurement Cost

- 10 % to 15 % of construction cost for the engineering fee
- 3% of equipment cost for engineering fee.
- 8 % of construction cost for physical contingency
- 10 % of construction cost for VAT

(4) Project Cost

Table 32.2.5 Project Cost for Short Term Development for Samarinda

(Unit in Million Rp.)

	Civil Work		Equipment		Total		
	Foreign	Local	Foreign	Local	Foreign	Local	Total
Samarinda - Existing Port	0	0	12,371	1,452	12,371	1,452	13,823
Palaran: 4-Berth Case	100,296	54,643	118,158	15,083	218,454	69,726	288,180
Palaran: 6-Berth Case	124,132	64,735	177,238	22,623	301,370	87,358	388,728
Land Acquisition: 4-Berth						13,200	13,200
Land Acquisition: 6-Berth						13,200	13,200
Compensation						15,000	15,000
Samarinda Total: 4-Berth	100,296	54,643	130,529	16,535	230,825	99,378	330,203
Samarinda Total: 6-Berth	124,132	64,735	189,609	24,084	313,741	117,010	430.751

32.3 Implementation Plan for Short Term Development of Samarinda

(1) Construction Presumption

1) Working days for construction
   Civil Works: 23 days/month
   Building Works: 25 days/month

2) Productivity of the Works
   Fabrication and Transportation of Steel Piles: three (3) month from order
   Dredging: 300 m^3/day (Clam shell mounted on barge)
   Reclamation: 300 m^3/day (by dump truck & bulldozer)
   Driving of Steel Pipe Pile: 2 piles/day x parties
   Driving of Steel Sheet Pile: 10 piles/day
   Concrete Work: 25 m^3/day
   Pavement (Concrete Block): 120 m^2/day
   Pavement (Concrete): 170 m^2/day
   Building Construction (RC Office): 10 m^2/day
   Building Construction (RC Shed): 20 m^2/day

(2) Project Implementation Schedule

1) 4 Berths Case
   - Detail Design: 7 months (January to July 2004)

- Bidding: 6 months (July to December 2004)
- Construction: 22 months (Jan. 2005 to October 2006)
- Procurement of Equipment: 17 months

2) 6 Berths Case
   - Detail Design: 7 months(Jan. to July 2004)
   - Bidding: 6 months (July to December 2004)
   - Construction: 24 months (Jan. 2005 to December 2006)
   - Procurement of Equipment: 18 months

32.4 Operation and Management Scheme

The study team proposed the following:

(1) To establish a cost-sharing system of port development, port management, and safe navigation
(2) To review the Port Working Area and Port Interest Area according to the new port regulation (No.69/2001)
(3) To improve the current port administrative services by simplifying the formats, and introducing a EDI system and manual system
(4) To relocate the port related offices
(5) To conduct staff training to realize efficient port activity

32.5 Economic Analysis of the Short Term Plans at Samarinda

This section looks at the proposed short-term river port development at Palaran and development of the existing port. There are two main alternatives (4-berth or 6-berth container facility) at Palaran.

The study establishes the preliminary EIRR and NPV of these Master Plans.

The economic/shadow pricing of the financial capital costs established in another part of the study are prepared along with maintenance and operating costs.

The project life is 33 years from the first expenditure providing some 30 years of benefits, although after 20 years the discounted costs and benefits are small.

Benefits are based on less waiting and berth time for larger ships and avoided land transport costs if the project is not built.

Some costs are incurred because Palaran is 20 km from Samarinda city.

The differences between the evaluation of the Samarinda Master Plan and the short-term plan include:

1) Benefits are maintained constant after the short term capacity is reached
2) Operating costs are also maintained constant from the short term capacity year
3) Only benefits are included which relate to the short term capital costs

It is estimated that the 4-berth scenario generates an EIRR of 22.1 % and the 6-berth scenario 18.8 %.

Both scenarios are viable and that is partly due to rapidly expanding container traffic and predicted high berth congestion if there is no port development. The project would be an important contributor to the economic development of the region.

32.6 Financial Analysis

32.6.1 Objective and Methodology of Financial Analysis

(1) Objective

The purpose of the financial analysis is to evaluate the financial feasibility of the project (The project means the short-term development plan at Palaran in this section.). When evaluating the financial viability of the project, financial soundness of the executing agency , that is, IPC 4 Samarinda Branch Office, is also assessed.

(2) Methodology

The viability of the project is analyzed, using the financial internal rate of return (FIRR) by means of the discount cash flow method. The financial soundness of the executing agency is also appraised, based on its projected financial statement.

(3) Assumption for Financial analysis

Preconditions of financial analysis are shown in Table 32.6.1.

Table 32.6.1 Preconditions of Financial Analysis

Base Year	Year 2001
Project Life	30 years
Revenue	Calculation based on port tariff 2001 (Also raised tariff in 2018) and forecast of cargo volume
Expenditure	
・Investment	Initial investment cost include tax.
・Re-investment	Gantry crane 25 years, RTG 20 years, Mobile crane 15 years. Forklift and tractor 10 years each.
・Maintenance and repair	Infrastructure: 1.6% of original construction cost. Equipment: 2.6% of original purchasing cost
・Personnel and administration	Calculation based on personnel plan and the existing scale of payment/
・Depreciation	Calculation by means of the straight line method, based on IPC4 standard.
・Tax	Income tax and deemed dividend tax.
Fund Raising	
・Foreign loan	Loan period: 30 years, Interest rate: 1.0%, Grace period: 10 years, Proportion: 85 % of initial investment cost.
・Domestic loan	Loan period: 10 years, Interest rate: 18.0%, Proportion: 15% of initial investment cost

32.6.2 Evaluation of the Project

(1) Viability

FIRR (Financial Internal Rate of Return) of the project is 7.0% in 6-berth scenario, and 11.0% in 4-berth scenario.

(2) Financial Soundness

The projected financial statements and financial indicators (Rate of Return on Net Fixed Assets, Debt Service Coverage Ratio, Operating Ratio, and Working Ratio) with regard to the project, are shown below.

1) Profitability

The rate of return on net fixed assets exceeds the weighted average interest rate of funds (3.55%) from the beginning of operation.

2) Loan Repayment Capacity

Throughout the project life, the debt service coverage ratios exceeds 1.75 (World Bank Standard), satisfying the required criteria.

3) Operational Efficiency

Both the operating ratio and the working ratio maintain the positive level.

32.6.3. Sensitivity Analysis

Sensitivity analysis was carried out to examine the impact of unexpected future changes such as cargo volume, construction cost, and revenue reduction. The following cases were envisioned.

Case 1 : Investment costs increase by 10%.
Case 2 : Port revenues decrease by 10%.
Case 3 : Investment costs increase by 10%, and port revenues decrease by 10%.

Results of the sensitivity analysis are shown in Table 32.6.2. In all cases, FIRR exceeds the weighted average interest rate of the funds (3.55%).

Table 32.6.2 Results of Sensitivity Analysis

Case	Palaran 6-berth Case	Palaran 4-berth Case
Original Case	7.02%	10.99%
Case 1	5.70%	9.58%
Case 2	5.56%	9.44%
Case 3	4.24%	8.09%

32.7 Environmental Impact Assessment

Since possible environmental impact with the project activities was identified in Chapter 31 "Initial Environmental Impact Examination", the concept of environmental management plan involving mitigation measures is described in this section.

32.7.1 Mitigation Measures

Table 32.7.1 Summary of Environmental Management Plan for Samarinda and Palaran

Environmental Impact	Mitigation Measures
Soil inflow	Since soil inflow from port area is anticipated, a discharge water treatment facility should be established during the construction and operation phases.
Air Pollution	Air pollutants from vehicles and handling equipment in the port area are expected, so air monitoring should be conducted and keep the pollutant emissions below the standards. Vehicles and equipment should be maintained in good condition.
Water Pollution	Inflow of water pollutants should be avoided, and removed at a discharge water treatment facility during construction and operation phases of the project. Drainage is also comes from Samarinda downtown so the pollutants whether from the downtown or the port area should be surveyed by continuous monitoring of water quality in Mahakam River.
Relocation of People	As a result of environmental survey, relocations of the sawmill factory and employee residences are expected with project implementation. Detail relocation program should be planned and implemented in conformity with relevant regulation of Indonesia.
Environmental Education	The proponent (IPC) of the project should hold the meetings explaining project activities, environmental surveys and environmental monitoring surveys to the communities along the accesses roads, also with brochures. Traffic safety oriented education is very important for the people living along the access roads, since the traffic volume increase is expected. Moreover the proponent (IPC) should communicate frequently with the communities affected by the project.
Opportunity of Employment	Employment of the people living around the project sites is recommended to take high priority over the other people.
Landscape	The color of painting of New structures in the port should be harmonized with the landscape around the port.
Topographical Change	Since Environmental Impacts to the river ecosystem and marine ecosystem by dredging and construction works is anticipated, appropriate work methods should be employed.
Fauna and Flora	Protected species do not exist around the project sites, however there are birds, livestock, and orchards and coconut plantations in the Palaran site. Therefore toxic substance should not be drained.
Mangrove Community	A mangrove community does not exist in either Samarinda or Palaran.

Land Acquisition	Land acquisition should be implemented in conformity with the relevant regulations in case it is needed for access roads.
Fishery Rights / Common Rights	Fishermen work in Samarinda, Palaran and estuary. The fishing grounds are isolated from the navigation channels; so fishing boat collision accidents with big ships is not easily expected. However, river transport in Samarinda is developed for products and passengers, so it is necessary to pay attention to safety navigation and prevention of collision accidents.